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Space Heating

IT frequently happens that the power consumed for electrically heating two rooms, apparently identical in every respect, varies as much as 30 per cent. or more. In cold weather with a high wind, for example, a poorly-fitting window may be sufficient to produce marked variations, and it is therefore quite impossible to obtain reliable data by comparing separate installations. But the number of different types of heating apparatus now on the market has created a general demand for information which will enable their relative merits reliably to be assessed. Accordingly, the school-heating test records which will be found elsewhere in this issue assume great importance in providing data of the type so much desired.

The tests were carried out on an actually existing installation, and the conditions of test approximated very closely to those of normal use, the control of commercial installations by means of the eupatheostat being comparatively novel. In general, the results obtained demonstrate the superiority, in the particular class of room under consideration, of a carefully thought-out system of radiant heating over the older-established tubular heaters. For example, in the second set of tests the two systems were switched on simultaneously for convenience; it is apparent, however, that the radiators should have been switched on considerably later than the tubular heaters in order to enable the same degree of comfort to be reached simultaneously in the two rooms. Had the radiators been switched on one hour later, the difference in power consumption would have been increased from 15 to approximately 30 per cent. Again, the first set of results plotted should deal a heavy blow to that popular fallacy which may be described colloquially as the "B.th.u. complex," for when designing installations it is the practice to calculate the heat losses from the building in question, and then to reduce the loss so determined by multiplication by a suitable constant in order to obtain the load required for the type of apparatus to be used.

Examination of the dotted curves produced shows, however, that the air temperature differed widely with the different systems, and it will also be noticed that after four hours' running the curves are by no means flat. Therefore, in actual practice an installation will seldom run for more than three hours consecutively, and the steady conditions for which the heat losses have been calculated will thus rarely, if ever, be obtained. Correction of the calculated heat loss by means of a constant may be accurate for the particular room in which the necessary experiments have been carried out, but it would seem that the principle of calculated heat losses is fallacious. Recent research indicates that the specific heat of the materials used in construction is at least as important as their thermal conductivity. As a matter of interest, the calculated heat loss from the classrooms in question, assuming 60 deg. F. inside air temperature, 30 deg. F. outside, and four air changes per hour, amounts to 8.42 kW. At the moment, therefore, it may be said that no rational method exists of calculating the load required for an electric heating installation, and

it is therefore necessary to rely almost entirely on past experience. If the latter is to be correctly interpreted, it is of the first importance that the testing should be carried out on a sound basis, so that it is to be hoped that the excellent example set by this research will stimulate the extension of experimental work on actual installations of all types. This method, besides the important merit of cheapness, has the great advantage of providing the type of information so greatly needed in a more effective and simple manner than can be obtained in special buildings erected for the purpose, useful as the latter may be.

The test results referred to strongly support the view that no one electrical heating system should necessarily be adopted by itself for any given installation, or, indeed, part of an installation. The tubular and radiant systems are in many cases technically complementary to one another, and for that reason alone the formation of the new company of Barker, Young & Co., Ltd., with the main object of producing as near as possible ideal space heating for any installation from one or more of the systems in question, with the most efficient control possible, is particularly welcome.

Argentine Activities

AN official of the United States Department of Commerce, according to *The Times*, has resigned on account of criticism of a pamphlet in which he alleged that British trade propaganda was calculated to disturb the peaceful relations of Argentina and the United States. This is evidence of a certain liveliness on the part of British traders in Argentina, although the allegation may be considered somewhat exaggerated. The penetration of American commerce into Argentina during the past five years, on account of which much British trade has been lost, was never looked upon as a disturbance of peaceful relations between Argentina and Great Britain, however much it was resented. The efforts of our people to regain this lost trade should not be so harshly interpreted by the Americans. It is clear that the effort which resulted in the magnificent Buenos Aires Exhibition is to be sustained, as indeed it must be if the fruits of the display are to be gathered. The Federation of British Industries is taking practical steps to keep up interest and activity in the South American markets by means of its Argentine Committee, which has drawn up a definite programme likely to produce useful results. The fact that Mr. V. Watlington, chairman of the B.E.A.M.A. Council, is chairman of the Committee should ensure that electrical matters are given at least equal attention to that bestowed upon other openings. Moreover, we trust that when the B.E.A.M.A. has considered the report of its special representative, Mr. H. C. Siddeley, it will also formulate measures to assist its members trading with Argentina, either in conjunction with, or independently of, the F.B.I. Committee.

Antiquated Fittings

IN a recent address, the director of the South African Lighting Association said that the lighting of public buildings and hotels in South Africa was very much out of date; more often than not the old type of conical shade was in use. Our reason for mentioning this is to remind readers that it is not necessary to go so far afield as South Africa to find that electric lighting fittings have not kept pace with electric lighting. At the recent E.C.A. Conference Mr. H. T. Young raised the same point and urged electrical contractors to persuade customers to abandon the conical shade in favour of more modern and efficient fittings. In the survey undertaken as a preliminary to its Factory and Workshop Lighting Campaign, E.L.M.A. found similar conditions prevailing in industrial establishments. Indeed, it is obvious to anybody that the outmoded conical shade is far too much in evidence. Here is a great deal of business going begging. It should need but little persuasion to convince the public of the absurdity of continuing to adhere to obsolete methods in the employment of the most up-to-date illuminating agent.

A Score

IN tackling a prospective industrial consumer, the supply engineer is often at a loss for an effective reply when confronted with the assertion that by installing his own generating plant the manufacturer could produce electricity at a lower rate than he could buy it. Here is the substance of the correct answer: it is far better for the manufacturer to use the capital, time, floor space, &c., necessary for installing and running separate generating plant for the development and selling of his own commodity. That is a fact which progressive manufacturers will be quick to realise, and one that is well worth driving home. It was voiced recently by a very large and up-to-date Midland manufacturing concern which has modern boiler plant installed, purchases electricity on a large scale, and could make out an unusually attractive proposition for combined electricity and process-heat generation. Its resolve to sacrifice the apparent advantages of generation on site and leave the business of electricity production to the public supply undertaking represents the broad view.

Contractors and Hire-purchase

IN our last issue we published a letter from Mr. J. Gibson Jarvie, the principal of a hire-purchase financing company, in which he suggested that contractors were slow to avail themselves of the hire-purchase facilities which were open to them. This week we print a rejoinder from an electrical contractor who avers that the path which Mr. Jarvie points out is not "roses, roses all the way." In other words, the requirements and conditions of the finance houses are not so favourable as the terms granted by electricity supply authorities. It is reasonable for a hire-purchase finance concern to insist upon guarantees, for, after all, its objects are commercial not philanthropical. At the same time we cannot believe that such a concern, if it wants to do business, will impose terms which are absolutely unacceptable to prospective clients. However, there may be scope for some relaxation of the rules which could be determined by discussion between the parties concerned, and in view of the importance of hire-purchase in domestic electrification schemes we consider that such discussion is very desirable.

Charges for Transmission

A CORRESPONDENT has sent us a cutting from a local paper, evidently inspired by someone with technical knowledge. The article bears out Mr. A. J. Fuller's contention that a power company's charges for transmission may be a formidable increase on the grid tariff. A case is mentioned in which the addition is as much as 30 per cent. It is suggested that the smaller undertakings are providing the power company with free transmission lines; this view, which we believe to be widespread, can hardly be quite correct, since if other supplies are given from the same lines, all the charges could not reasonably be allocated to the bulk supplies. The undertakings involved ask to be allowed to negotiate directly with the Central Electricity Board, but, even if this were permissible under the 1926 Act, it would still be economically necessary to use the power company's lines. Provided that other load can be secured in the early stages and the lines are required for general development, then any charge that would provide a margin after covering the cost of the extra copper necessary would make it worth the while of the company to give the bulk supply.

Maximum and Average Speeds

THE discussion on the *pros* and *cons* of railway electrification continues in the lay Press. Reference is frequently, and rightly, made to the importance of obtaining higher overall speeds, and it is asked whether with electrification speeds of 80 to 100 miles an hour would be feasible. An important point in favour of electrifying a railway is that without increasing the maximum speed (which may be already as high as is suitable for the permanent way) a much better average can often be maintained, as there is a greater reserve of power to deal with adverse gradients.

A TRACTOR MANUFACTORY

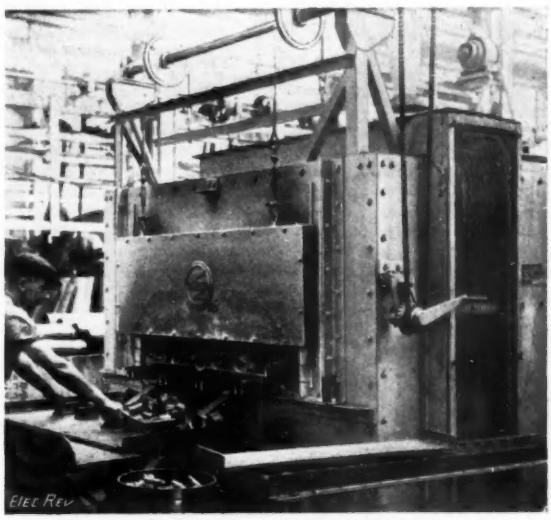
Electricity is used extensively for all purposes in the Ford tractor works at Cork, in the Irish Free State, including a.c. furnaces, it being mercury-arc rectified for d.c. motor driving

By R. N. TWEEDY

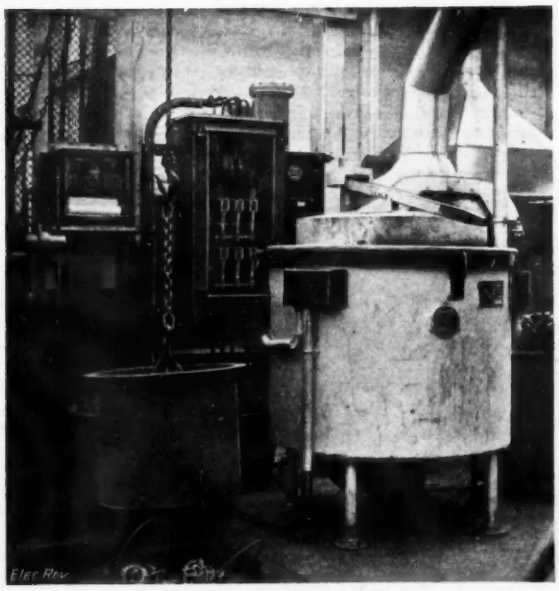
AMERICAN industrialism, as we have seen it in Ireland, is a perturbing phenomenon. Not so many years ago Mr. Henry Ford secured a virgin riverside site just below Cork City, and proceeded to build a factory for the mass production of the famous "Tin Lizzie." A big internal-combustion power plant was installed, and thousands of men were put to work at rates which upset the local employers dreadfully; and, in fact, had reactions of greater or lesser importance throughout the Irish Free State. It was thought better to be a doorkeeper in the House of the Ford than to be a foreman fitter in native engineering works.

The factory grew, and Cork was thought to be a lucky city to have been discovered by one of her "exiled" sons. There was much criticism of American methods, and every employer of labour was bitter in his wrath about the disturbance of the labour market. In due course, however, it became apparent that the employment curve in the new factory fluctuated more widely and more erratically than the load curve of a traction power station, although the time base was on a different scale, and the impression grew that £5 a week for six months of the year was not so attractive as £2 a week during the full twelve months.

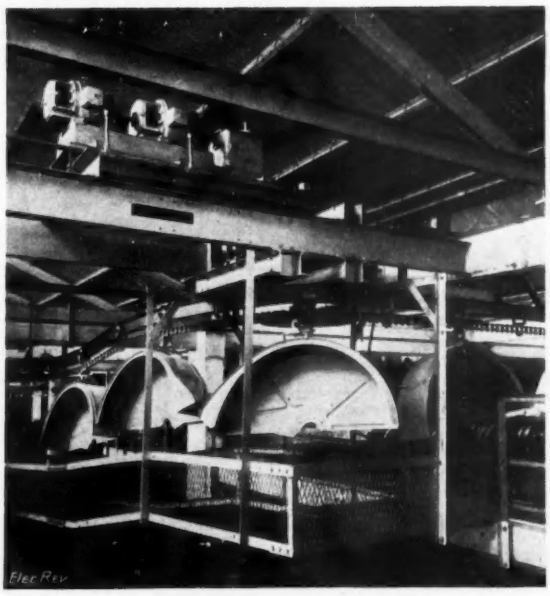
Then came the decision to shift the motor works to Manchester in England, and for a time no one in Ireland knew what was to be the fate of the Cork works. The Ford activities are not unlike a South African river: one day a trickle along the bed of the *spruit*, the next a torrent filling the channel to the brim, and the next not enough water to fill a kettle. So it was not altogether surprising to hear that the factory was to be enlarged in order to house the tractor plant then operating in Detroit, U.S.A., the idea being to supply the European market from the banks of the River Lee—or so we heard. Sure enough, the extensions were built, the Detroit factory sailed over to Cork, and the official trade statistics for



Pusher Furnace: Discharge End



"Birlec" Vertical Forced-draught Tempering Furnace



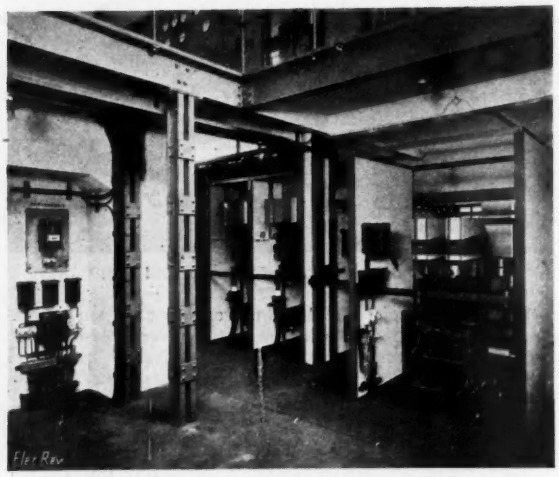
Electrically-driven Conveyor: S-bend

year ended December 31st, 1930, show that Ford tractors and component parts thereof to the value of nearly four and a half million pounds had been built up during 1929 and 1930, the figure for 1930 being over three-quarters of a million better than that of the previous year.

Then I was given every facility by Mr. Clarke, the general manager, and by Mr. Zierold, the works manager, to go over

Cork City Rotary Sub-station

the factory with Mr. McNamara, the works electrician. There were some 2,000 to 3,000 men at work, and it was hoped that the demand for tractors would call for double the number of men before long. In the meantime the huge works at Dagenham on the River Thames east of London is being created, which makes a forecast of Cork's future more difficult than ever. At the moment of writing it is rumoured that



Sub-station Bus Couplers and Feeder Switches

the Cork works is almost closed down, and that the foundry is to be moved "holus bolus" to Dagenham.

None of these things affect the purpose of this article, which is to describe briefly the electrification of the factory.

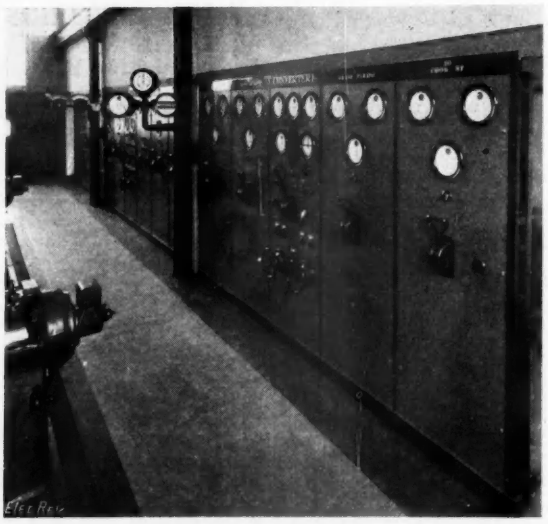
The original power plant of the car factory consisted of a 1,000-kW producer-gas engine and dynamo with the City supply brought in as an alternative. Another 2,000 kW of steam plant was added when the factory was changed over to tractor production and about 1,500 kW was taken from the City supply. The maximum load at that period was about 3,500 kW.

When the national (River Shannon) supply became available Ford's decided to shelve their own plant entirely in favour of the public supply, and a contract was placed by the I.F.S. Electricity Supply Board with Messrs. Siemens-Schuckert for the complete transforming and rectifying plant now installed in the factory sub-station. Messrs. Siemens-Schuckert were responsible also for the 110-kV outdoor terminal switching and transforming station at Kilbarry on the outskirts of Cork City under the main Shannon hydro-electric development contract, as well as for the rotary-convertor sub-station in the City and the 10-kV cables linking the Kilbarry, the City, and Ford's works sub-stations.

Two 1.0-sq. in. and one 1.25-sq. in., 3-phase, 10-kV, cables have been laid from the 110-kV terminal station through the City sub-station to the Ford sub-station and the old City generating station (illustrated in the ELECTRICAL REVIEW for May 15th, 1931, p. 821) is connected both to the City sub-station and to the Ford sub-station by 4,000-ampere d.c. feeders. Thus, Ford's factory is well-assured of continuity of power supply under almost any conceivable set of circumstances. A 3,000-kW steam set is kept hot in the old station for any emergency.

As the Ford plant was equipped from the outset with d.c. motors, it was necessary to convert the national a.c. supply, and that applies also to the City distribution system, which is 460-230 V three-wire.

City sub-station.—In this very well-designed building are housed 3 rotaries, each of 1,840/2,080 kW at 460/520 volts 4,000 amperes. One of them is started from the d.c. bars, and the others from the a.c. side by means of tappings off the three main transformers, which are each rated at 2,300 kVA. From the 10-kV double bus-bar system these transformers can



Main Sub-station Switchboard

be operated separately or in parallel. All are provided with motor-driven on-load tap-changing gear with 33 tappings, controlled either manually by push-buttons or automatically by potential relays.

Isolating links enable the City system or the Ford sub-station to be disconnected from any of the three incoming 10-kV cables.

The convertors deliver to the d.c. double bus-bar system, which supplies ten feeders of 1,500 amperes capacity, and one of 4,000 amperes interconnecting the existing steam station.

The watt-hour meters on the 10-kV feeders record energy supplied to the sub-station, while a remotely controlled maximum-demand recording instrument integrates the readings of the three individual meters.

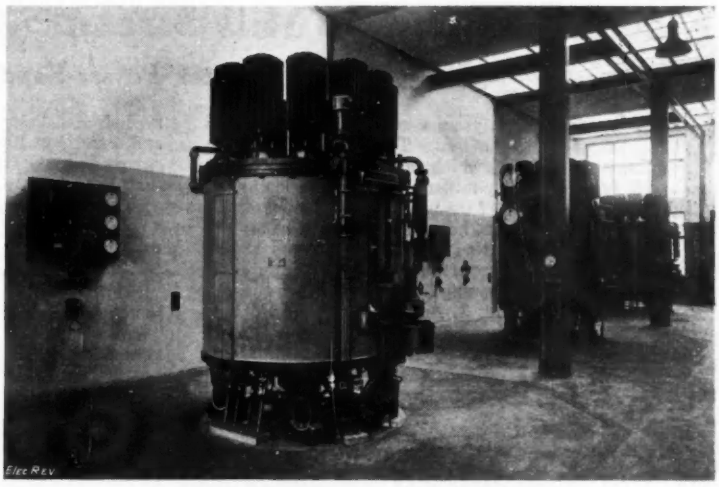
Ford sub-station.—Here again appear the three 10-kV cables which were linked into the City sub-station. They will be extended in due course to transmit power to other sub-stations or the general distribution system of the area.

The double bus-bar 10-kV system supplies 3,080-kVA transformers with on-load tapping similar to those in the City sub-station.

Factory Furnace Remote Auto-control Board

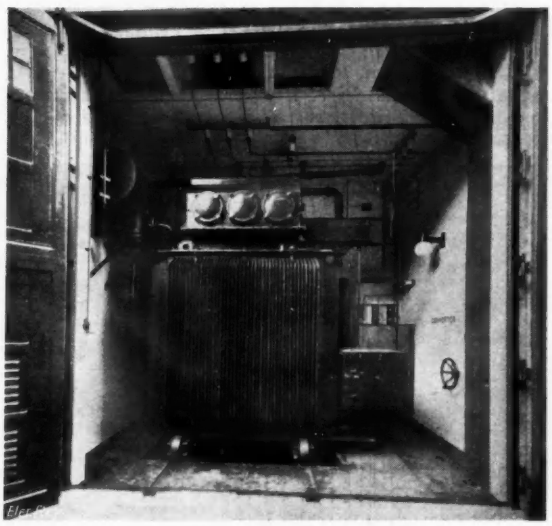
Conversion is effected by means of three metal-clad mercury-vapour rectifiers, which, at the time they were ordered, were the largest sets hitherto made. Their individual outputs are 4,000 amperes at 460/520 volts d.c. The really astonishing manner in which this type of rectifier has overcome the uneasiness felt by most supply engineers, and the prejudice of many whose experience had been wholly with convertors proper, is well exemplified by the fact that the period between the placing of the Cork order and the completion of the erection saw the growth of output per unit rise to 16,000 amperes at from 500 to 600 volts.

The performance of the 4,000-ampere sets at Ford's factory has been entirely satisfactory since a certain amount of trouble with back firing in the early stages was overcome, and the load conditions are comparable with those commonly met with in traction sub-stations. The Messrs. Rissik's paper on heavy-duty rectifiers, recently read before the I.E.E. in London and elsewhere, is the best possible introduction to a study of this remarkable apparatus.



Metal-clad Mercury-arc Rectifiers in Factory

The job at Ford's factory was not at all a straightforward one, because the existing d.c. switchboard had to be removed from its original position in the factory and re-erected in the new station. This had to be done panel by panel without interrupting the supply to any part of the factory. The new double bus-bar system is connected directly to the bus-bars on the old switchboard. One d.c. feeder of 4,000 amperes connects this and the City steam station. Two 500-kVA transformers of 10,000/380/220 volts are provided for the a.c. supply to the electric furnaces and other power and lighting requirements. From these also is drawn the energy demanded by the rectifiers, auxiliaries for exhaustion, ignition and excitation.

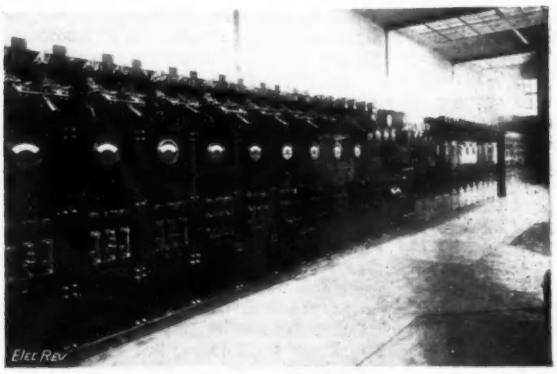


Sub-station Transformer Chamber

The watt-hour meters on the 10-kV side and on the d.c. feeders register the energy supplied to the station, and, in the latter case, any supplied by the station to the City steam station. The integrating maximum-demand recorder registers the total energy whether a.c. or d.c., less any d.c. which has been derived from the rectifier and then delivered to the City.

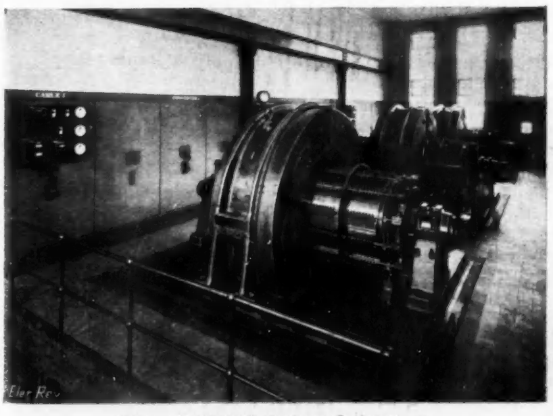
The City's power station was erected where it still stands in Albert Road; its present total capacity is 7,000 kW and the maximum load is 6,000 kW, in addition to the traction load. It contains three B.T.H. Curtis steam turbines (one of 2,500 kW and two of 2,000 kW) driving, through gearing, two dynamos each, one of which is for use on the City's supply, the other being available at times of light load when both lighting and traction can be supplied off the one set.

In April, 1930, the lighting and power business was purchased by the Electricity Supply Board, and the whole steam station has been relegated to the position of standby to the Shannon hydro-electric supply, delivered through a rotary-convertor sub-station.

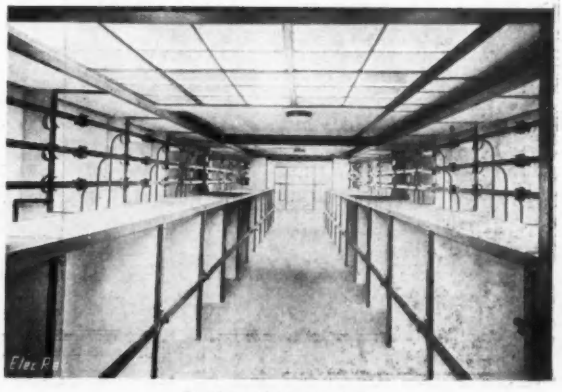


Works d.c. Switchboard

The forward policy pursued by the Cork Tramway and Lighting Company placed its undertaking in a strong financial position and enabled terms to be quoted to Henry Ford and Son which made it possible for that firm to lay up its own power station in favour of a bulk supply. In 1929, out of 15,599,823 kWh generated, not less than 6,805,115 were sold to Messrs. Ford & Son.



Three 2,000-kW Rotary Convertors



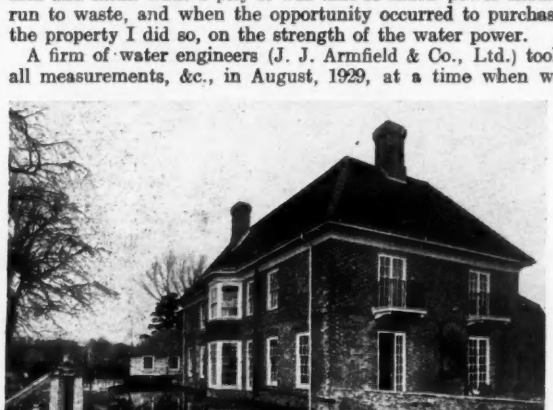
Bus-bar Arrangement

Electricity from a Mill Stream. By Theo. A. Stephens

A Cheap Water Power Supply

MY home was, until two years ago when I bought it, a mill house adjoining a mill. The mill itself had an old-fashioned wheel which developed 25 h.p. It seldom worked, for the country miller's business has long since been killed by the competition of the internal-combustion engine and railway sidings. For years, however, I used to watch this mill and think what a pity it was that so much power should run to waste, and when the opportunity occurred to purchase the property I did so, on the strength of the water power.

A firm of water engineers (J. J. Armfield & Co., Ltd.) took all measurements, &c., in August, 1929, at a time when we



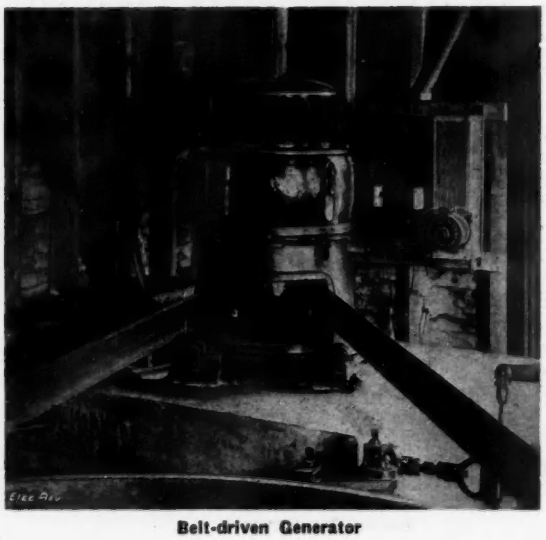
The Mill House

had experienced an almost record period of drought, and on the water then available they based their estimates, and a turbine was installed about seven feet below the engine-room floor of the specially built power house and four feet below water level. It drives a 15-kW vertical dynamo by means of a belt. The turbine is governed by regulating shutters which vary the amount of water according to the load on the dynamo. The power house can be seen spanning the river just below the house shown in the illustration above.

I pulled down the old mill entirely, and by putting in new windows throughout, a cove under the eaves, balconies to several of the windows, a new front door, and throwing out a bay window over the river, I converted what was a characterless, in fact a rather ugly, house into one which, as will be seen, has some charm and dignity.

Knowing that, once the plant was installed, I was to get what is, virtually, free current I was lavish in the number of points wired. I not only allowed for lighting and heating points where I thought I should want them, but put them anywhere where it was possible they might, at some future time, be useful. In similar circumstances I should do the same thing again, for a number of the points I did not anticipate needing, at the time they were put in, have proved exceedingly useful.

The house contains eight bedrooms, three bathrooms, three reception rooms, kitchen and pantries, cloakrooms, &c. The



Belt-driven Generator

kitchen is fitted with a large size "Creda" electric cooker, and, as a stand-by in case of accidents, I also had a small gas cooker installed, but this is seldom used. The accidents that have happened have not taken long to put right, and the chief use of the gas cooker has been in times of flood. In a severe flood we lose a good deal of power and cannot afford to use the cooker at full pressure, but floods seldom last long and in two winters have not seriously inconvenienced us.

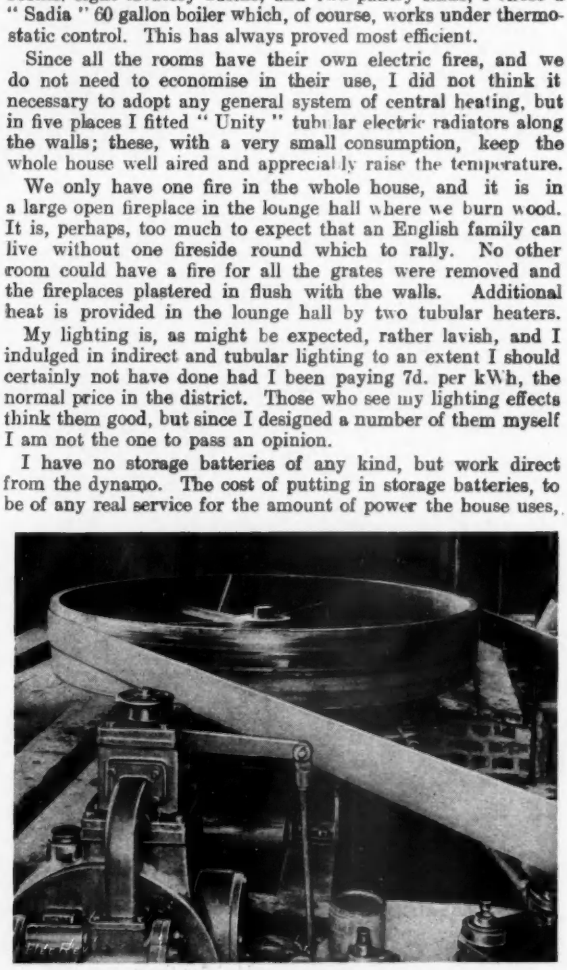
For the domestic hot water which has to supply three bathrooms, eight lavatory basins, and two pantry sinks, I chose a "Sadia" 60 gallon boiler which, of course, works under thermostatic control. This has always proved most efficient.

Since all the rooms have their own electric fires, and we do not need to economise in their use, I did not think it necessary to adopt any general system of central heating, but in five places I fitted "Unity" tubular electric radiators along the walls; these, with a very small consumption, keep the whole house well aired and appreciably raise the temperature.

We only have one fire in the whole house, and it is in a large open fireplace in the lounge hall where we burn wood. It is, perhaps, too much to expect that an English family can live without one fireside round which to rally. No other room could have a fire for all the grates were removed and the fireplaces plastered in flush with the walls. Additional heat is provided in the lounge hall by two tubular heaters.

My lighting is, as might be expected, rather lavish, and I indulged in indirect and tubular lighting to an extent I should certainly not have done had I been paying 7d. per kWh, the normal price in the district. Those who see my lighting effects think them good, but since I designed a number of them myself I am not the one to pass an opinion.

I have no storage batteries of any kind, but work direct from the dynamo. The cost of putting in storage batteries, to be of any real service for the amount of power the house uses,



Hydraulic Plant

would probably be more than that of the whole plant, so the possibility of doing this was not even considered. The governor on the modern turbine is so efficient that the variation of light, even when a heavy load is put on or taken off, is seldom perceptible, so there would be little advantage to be gained from storage batteries except in the case of a breakdown, which one always has to anticipate; but at my flat in London I have experienced more and longer periods of breakdown in the electricity supply than I have in the same period from my turbine plant.

Allowing for 10 per cent. on the capital cost and for all running expenses, I calculate that the electricity I have used during the past twelve months has cost me less than 0.1d. per kWh. The 10 per cent. for interest and depreciation is a generous figure, for a water turbine is a slow running machine, most working parts being under water, and its life should be long.

I should like to find some use to which I could put electric current when the house does not require it, but up to the present I have not been able to find any way in which I can get any economic return.

While I know I am not by any means the only one who is making use of water power in this country, there are thousands who could do so to their own great gain, and it is a pity that more people within reach of streams and rivers do not take the gift that nature offers them.

A Composite Block Tariff. By L. G. Hill, A.M.I.E.E.

Teaching the consumer to think in terms of hundreds of kilowatt-hours

THE chief problem confronting supply engineers has always been the attainment of a high load factor. Even when supply is given to a large industrial load or for tramways or railways, there is always a peak in the winter evenings when the lighting load overlaps the industrial load, presenting a problem for which no satisfactory solution has yet been found.

Where direct-current distribution has been adopted batteries have a limited application, but the new system of bulk supplies from the national grid will eliminate d.c. distribution to a very large extent.

The lack of a suitable standard tariff is probably the greatest obstacle to domestic electrical development. Let us first consider what an engineer has to pay for his "bulk supply juice," and see how best these charges can be applied to domestic consumers. First, he is called upon to pay an annual charge based upon actual kW or kVA of demand as measured by a demand indicator; this is to cover capital charges on plant and other standing charges. Secondly, he pays a flat rate for all electricity consumed, which sometimes decreases as the total consumption increases.

This total sum, plus a generous allowance for the costs of his own undertaking, must be distributed over his consumers with as few meters as possible, and it is obviously to his advantage to attempt to attain the lowest maximum demand with the highest attainable energy consumption.

Now, the general public hates a variety of tariffs, and I think it will generally be conceded that a universally adopted standard tariff for all purposes would give domestic electrification the greatest push it has known.

Domestic tariffs now in use generally consist of a fixed charge, which is based upon either (1) rateable value, (2) floor area, (3) actual maximum lighting demand measured over a definite period, or (4) number of lighting points installed, and, in addition, a flat "follow on" rate, which is, in effect, a close copy of the undertaking's bulk supply bill, the fixed charge taking care of the lighting peak. This fixed charge often causes trouble, because every method of computation has distinct disadvantages. Rateable value, for instance, penalises a house situated on the main road when compared with similar houses on side roads; floor area penalises small families living in large houses; maximum demand can only be measured during winter months; and lighting points generally include annoying wattage restrictions.

In carrying out a large number of such valuations for a prominent metropolitan undertaking, I came to the conclusion that on an actual basis of metered maximum demand (the obviously fair method of estimation) the fixed charge rose up to a certain point with the size of the house, and then remained approximately stationary for all houses beyond that size. I would place a fair average valuation at £4 to £8 per house depending upon the undertaking.

The consumer, however, views the fixed charge with disfavour, but if it be distributed over, say, 200 kWh per annum, the consumer would be satisfied and the undertaking would not suffer.

Now for the follow-on rate: with electricity at 1d. per kWh, a 25 per cent. reduction must be possible before it can conveniently be passed on to the consumer, who does not want to be bothered with decimal points in his account. Why not, then, take a leaf out of the gas companies' books and sell electricity at so much per 100 kWh? (one could hardly imagine gas being sold in units of 10 cubic feet with much success). Reductions at 3d. per hundred kWh could easily be made at frequent intervals, and, in addition, the consumers would automatically learn to think of electricity in terms of hundreds of kWh rather than kWh.

I would, therefore, suggest an all-round tariff to include the fixed charge evenly spread over the first 50 kWh per quarter, plus the price per kWh to the nearest farthing of the follow-on rate of so much per 100 kWh. Thus, a fixed charge of £5 per annum and a follow-on of 1d. per kWh becomes 1,200/200+1=7d. per kWh for the first 50 kWh per quarter, plus a follow-on rate of 8s. 4d. per 100 kWh.

This tariff applied to all domestic supplies would eliminate flat rates, as a plain flat rate at a reasonable charge would be paid for an average lighting consumption—and a single meter would suffice for each installation.

The same tariff could also be applied to shop lighting; the higher rate, however, would be applicable to a proportion of the account, varying with the installed display load (say for the first 50 kWh per quarter per installed kW of lighting load), the valuation in this case covering window display, counter and exterior lighting, but not including store rooms, passages and rooms reserved for the staff.

Would such a tariff be acceptable to supply undertakings as a compulsory standard?

The Lounge, the Kitchen, and a Bedroom in the All-electric Mill House (*See opposite page*)

Physics and the Engineer. By W. E. Burnand, M.I.E.E.

The initiative in electrical science is passing to the physicist

FOR many years nearly all progress towards understanding the nature of the electron (implying also the proton) has been made by the physicist. Perhaps this is only natural, since the discoveries have been made as the result of probing into the innermost constitution of matter and the minute discrepancies in physics, details that had little apparent significance for the electrical engineer.

This insignificance has now gone, and we find that these small things—so small in fact that we call them things more from habit than because they possess attributes akin to those of what are usually termed things—are the determining factors of the physical world as we know it.

With the rapid rise of the vacuum tube to the realm of heavy engineering, and its imminence as a preponderant place in lighting, to say nothing of its world-wide dominance in "radio," electron engineering has "arrived" to a degree not commonly appreciated by electrical engineers as a whole.

As electrical engineering grew from microscopic beginnings, imperceptibly at first through its germination period and at an ever increasing rate to its present dominance, so electron engineering has got into its stride, and moves forward at a dizzy pace, with the physicist in the van and the electrical engineer somewhere behind.

Electrical or Mechanical?

It is debatable whether at the electron end, either "electrical" or "engineering" are correct descriptions, and the time would appear to be ripe for a series of definitions as to what we mean by electrical effects as distinguished from other attributes of atoms and electrons or groups of these.

In one sense, all observed effects are electrical, but we do not call it electrical transmission when power is sent through a belt, which is clearly different from power transmitted through the medium of a rotating magnetic field. We may say that the electrical one is the one that acts through the ether, which differentiates it from, say, compressed air transmission or ordinary mechanical transmission. A minor difficulty is that some deny that there is an ether.

The line of demarcation becomes less clear when one probes further into atomic and sub-atomic physics. Taking the instance of the belt, the pull of which on the tight side is said to transmit the power; the belt substance is said to be made up of molecules, in turn made up of atoms further divided into electrons and protons. The solidity of the material is found to be due to the extremely rapid motion of the electrons round the protons acting as nuclei to the atoms. Moreover, it is not easy to see how there can be a "pull"; the electrons are widely separated, and even in the case of a railway coupling "pulling" the carriage behind it, if this is examined closely it will be found that the end of the coupling is behind the hook, and exerts a push at the point of application.

Protons and Electrons

It has been known for a long time that the mass and size of the electron is small relative to the apparent size of the atom, so it was assumed that the proton was relatively large and massive compared with the electron. The exceedingly rapid motion of the electrons acted as an effective cage round the proton, till Rutherford made use of alpha particles—exceedingly small and having a velocity approaching that of light, which could therefore readily get through the cage and hit the large and massive proton therein. When bombarding aluminium it was found that, instead of a large number of hits, only about two were made in a million shots. In other words, the cage was found was nearly empty, and putting X, Y and Z together it was found that the maximum space actually occupied by the electrons and protons could not exceed one million-millionth of the space apparently taken up by the atoms they constitute; hence we get those fantastic comparisons of a tennis ball and St. Paul's Cathedral, stellar space and the planets, and the like, as representative of the actual bulk of the electrons and the space apparently occupied by them. A further illustration, if my arithmetic is approximately correct, is that I should be just visible to anyone with good eyesight at close range as a minute speck, if I could be so thoroughly deflated that all the electrons constituting my body all touched.

This may be obviously absurd, but it corresponds with the facts irresistibly proven by the keenest physicists and mathematicians of the age, checked time and time again and confirmed, though we can please ourselves whether we think the earth is flat and that matter is what it seems, or reconcile ourselves to the results of modern physics and agree that we are very much inflated creatures with a real magnitude even less than imagined in our hour of greatest humiliation. It is, of course, still open to us to say that we are more than a more or less orderly concourse of widely separated electrons.

It will be readily realised that under these repeated shocks, the modern physicist is becoming cautious. He started with molecules, got to atoms, then electrons and protons, every time matter becoming more tenuous till we have arrived at a point with no real physical significance to us, being more like a number or series of numbers or symbols of a sort of inverted astronomical value.

The Relationship of Matter and Energy

Actually it is by no means certain that there is any more real substance in matter than in what we call empty space, and the modern physicist feels not too easy with the latest definition of matter as a "variation in space."

Further enlightenment and more uncertainties arise from the discovery that matter and energy have numerically interchangeable relationships, and that time also is inextricably connected with both, the whole somewhat analogous to an elastic ball filled with water, a depression or alteration at one point being equally compensated for by an alteration elsewhere. On top of this is the more recently discovered "unit of action"—Planck's constant or h quantum, being 6.55×10^{-27} erg seconds. This almost infinitesimal number is obviously of a most fundamental nature even though hard to define in ordinary physical terms. We have some idea of what is one watt-second. One erg is one ten-millionth of a watt - second. One erg second is thus one ten-millionth of a watt - second-second, which hardly makes sense in our usual way of thinking, but which works out alright with the four-dimensional Einstein system. It is not a unit of energy as we know it, but is called a unit of action. In somewhat the same way that a four-dimensional measurement may be given as 1 yard by 1 ft. by 2 ft. by 1 week, this minute unit of action may be considered as a minute unit of power×time×time. In the one case we get bulk×time, and in the other we get energy×time. Whatever the combination may be, this minute fraction of energy-time, with the twenty-six noughts behind the decimal point before one gets to a significant figure, is a number that continually appears in precise measurements. It is found that light is only given out and absorbed in bundles of that magnitude, and that when we deal with single units it is impossible to state with precision, this unit's velocity and position, these being so interwoven, that one affects the other in a manner introducing an uncertainty of the minute quantity h (Heisenberg's "Principle of Indeterminacy"). As all matter is composed of the smallest units many revisions will follow.

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"The Day of Small Things"

It is noteworthy how the most minute quantities are the vital determining factors of existence, from the microbe and the much smaller vitamin in the organic, to the "unit of action" and electron in the inorganic system.

When we get down to matter about the size of a light wavelength, the process of enlightenment and uncertainty continues, and it seems as though matter may be either a particle or a wave or interchange between the two, and our ideas of precision go astray.

A point worth noting is that nearly all these revolutionary discoveries are the result of following up minute discrepancies that were there for all to observe, but were ignored until someone who had "eyes to see and ears to hear" noticed the discrepancies, and following these up discovered for us this new realm in the world of physics.

There is no reason to suppose that all has been discovered.

Indeed, there is every indication that we are only on the threshold of discovery, and at no time has there been so great an opportunity as at the present for expanding knowledge and building thereon a new world of ideas, to be in turn utilised in controlling the forces of nature beyond present conception. May the wielders of this power be worthy of it.

The foregoing is, of course, only a mere outline of some of the features of modern physics, with many gaps and imperfectly expressed; in fact many features can only be expressed by mathematical formulæ and symbols having no meaning in physical reality according to present ideas.

I might here allude to a theory evolved by myself nearly 40 years ago when trying to find a connecting link between such incongruous diversities as the seven colours of the rainbow, the three primary colours, cell growth, and various numerical relationships. A curious clue led to the evolution or discovery of a sort of diagram or frame of reference linking together and showing the relationship between the organic and inorganic in an orderly manner, which has proved of great use through these many years in showing at any rate a plausible connection between a number of apparently unrelated phenomena. One result following from this theory is that what we call matter, and energy, is in all cases a compound of both, either singly having no physical attributes. A sort of incomplete analogy would be to say that the one forms the fulcrum for the other, without which no action is observed. This is not the same as the modern relativity theory which indicates that mass is a measure of energy, but I think will prove the solution to a number of difficulties now troubling physicists.

How electrical calculations will be altered by the new physics it is hard to say, but that they will be altered seems obvious by the two examples:—

(1) An electric charge at rest on the earth shows an electric field, but no magnetic field. An electric charge in motion is an electric current and therefore has a magnetic field associated with it. In the first case we have what we call a static charge, but as the earth is moving at great speed, the charge is also an electric current to all else in relative movement to it. A general formula should cover both cases.

(2) Matter—a ruler, for instance—being an assembly of electrons, must contract in length whilst in lengthwise motion. The relativity principle shows this shortening, quite independently of any electrical action, as a normal property of the "space-time continuum."

No doubt a clever mathematician could evolve a series of formulæ for the dynamo on the same relativity principles which might not convey much to the designer of to-day, whilst being in reality more correct as a whole. Apparently this would embrace the whole space in relation to the whole circuit outside as well as inside the dynamo, and no doubt would look very complicated to us, but being part of a comprehensive generalisation it will be recognised as a simplication as these generalised equations become familiar in course of time.

Summarising, the points I have tried to make are:—

(1) Pioneering in electrical science has passed to the physicist.

(2) Electrical science is rapidly developing a new technique with which the large body of electrical engineers is out of touch.

(3) This development proceeds at an accelerated pace, and it behoves electrical engineers to look ahead.

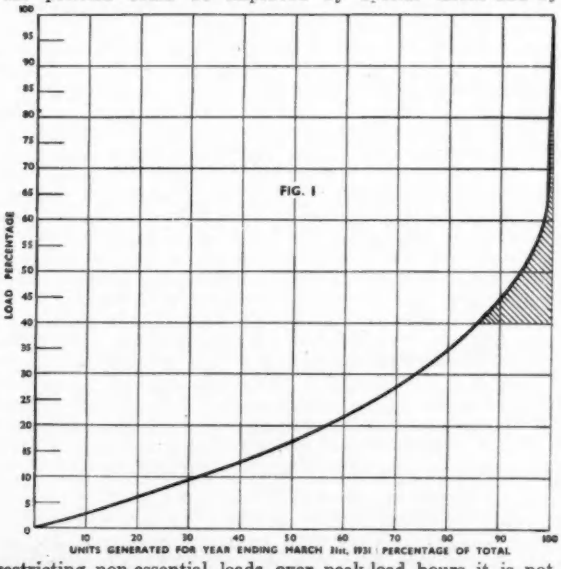
(4) Old landmarks in physics have been proved variable, and new ones, at present not too well defined in some cases, are coming into view. By keeping in touch with these discoveries, outlook is enlarged and a steadiness acquired that may enable one to use new discoveries instead of being merely bewildered by them.

Local Generation or Bulk Supply? By H. Wilson, A.M.I.E.E.

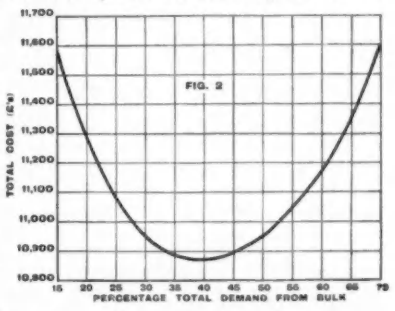
It is argued that 40% of the demand is the desirable proportion for bulk supply

THE following figures and observations are taken from the annual records of a small generating station which produced just over five million kWh during the year ended March 31st last, and I put them forward in the hope that they may be of interest to other small stations and to those taking bulk supplies on a two-part tariff. Half-hour readings were taken throughout the year and plotted to form a demand load curve, the area of which represents kWh generated and the heights of the ordinates representing the demand on a half-hour average. For each week the kWh associated with each 100 kW of demand from the base line up have been recorded, and these figures have been integrated for the year and used to produce the curve in fig. 1, in which the percentage of total demand is plotted vertically and the percentage of total kWh horizontally.

Although the station has a reasonable annual load factor (31 per cent), it is alarming to find that 65 per cent. of the demand covers 99 per cent. of the kWh, and that the top 35 per cent. of the demand corresponds to only 1 per cent. of the output, since the revenue resulting from this small number of kWh cannot be anything like sufficient to pay the capital charges on the plant required to produce the output. How far the position could be improved by special tariffs and by restricting non-essential loads over peak-load hours it is not the purposes of this brief article to consider.



This peak-load demand evidently calls for generating plant of low first cost and without standby losses. The running cost on the small number of kWh produced is of no great importance. On inquiry I find that Diesel alternators can be installed with buildings, foundations and accessories, ready to run, at £14 per kW, and in view of the short time which such plant would have to run per annum, a reasonable period for loan repayment would be 15 years. This corresponds to an annual charge of 10 per cent. to cover repayment and interest, or £1 8s. per kW per annum. Repairs and maintenance are generally allowed for in the running costs, but in view of the very small output of the plant it is hardly fair to do so in this case, and a better way would be to allow an annual sum of, say, 5s. per kW. This brings the standing charge per annum up to £1 13s., and I will allow another 7s. for insurance, rates and taxes, &c., making a total standing charge of £2 per kW per annum. With regard to running costs I will allow 0.22d. for fuel, 0.03d. for lubricating oil, 0.15d. for wages, a total of 0.4d., so that we have one source of supply with a standing charge of £2 per kW and a running charge of 0.4d. per kWh.



Now I am going to assume that a bulk supply is available at £4 5s. per kW and 0.2d. per kWh—quite good figures for a station 15 miles from a grid sub-station, and probably better than we shall obtain. It now becomes a simple arithmetical problem to decide what part of the load curve it is economical to take from the bulk supply, and how much should be generated locally to give the best overall result.

Last year we experienced a peak load of 1,980 kW and generated 5,390,000 kWh, and by the aid of the curve in fig. 1, and by taking trial amounts, it is easy to produce fig. 2, in which the total cost is plotted vertically and the percentage bought from bulk supply horizontally. It is obvious that the bottom of the dip in the curve produced gives the economic solution which is, in this particular case, that 40 per cent. of the demand should be bought and 60 per cent. should be supplied by local generation. Returning for a moment to fig. 1, I have shaded in the portion which should be generated locally, that is the top of the demand representing only 14.5 per cent. of the total kWh.

It would appear that there should be a good market for some years to come for Diesel engines at the distributing points in this country. Such a home market would go a long way to help British manufacturers to capture the foreign trade in oil engines, as there is an increasing demand for this type of plant for abroad and for marine work.

Finally, I would add that I have no personal interest in the oil-engine business, and am only concerned in providing a cheap and abundant supply of electricity.

Radio Station Interference. By C. R. Stoner, B.Sc.(Eng.)

Notwithstanding ingenious attempts at minimisation, the problem still awaits satisfactory solution

THE successful allocation of transmitting frequencies to the world's radio stations is rendered difficult for three quite distinct reasons. Thus, minimum separation depends upon (1) the band emitted when the transmitter is modulated to radiate intelligence, (2) the accuracy with which frequencies can be measured, and (3) the degree of constancy to which the transmitted frequencies can be maintained.

A station may be adjusted to radiate one frequency only if it is not transmitting intelligence, but so soon as we make use of it by modulating a carrier frequency f_c by a speech wave having a maximum frequency f_m, a band between $f_c - f_m$ and $f_c + f_m$ is radiated. When used for telegraphy, the repeated starting and stopping of the emitted wave is equivalent to complete modulation and other frequencies are radiated. A telegraph station operating at hand speed (say, 25 words per min.) radiates a band of about 50 cycles per second; a "high-speed" telegraph station (say 200 words per min.) a band of about 400 cycles. A commercial radio-telephone station will radiate a band of about 5,000 cycles, and a broadcasting station about 10,000 cycles. These bands are independent of the carrier frequency employed, and represent the minimum separation between two stations of such ranges and positions as would make them capable of mutual interference.

Transmitter Constancy

For a number of telegraph stations using the "short-wave" band (10 to 50 metres, or 30,000 to 6,000 kilocycles) a separation of about 500 cycles is all that is required, even when working at high speed, but if the transmission is on 15 metres (20,000 kc) this separation would only be 1 in 40,000; hence the frequency of each transmitter ought to remain constant and correct to about 1 in 100,000 to provide a reasonable margin.

Minimum separation in this case is likely to be governed by considerations of constancy of frequency rather than of width of frequency band transmitted. Immense improvements have taken place in the last few years with regard to the constancy of transmitters.[1] With valve-maintained tuning forks, quartz cystals, and specially-designed valve oscillators accuracies rather better than 1 in 50,000 can be obtained. Better results can be obtained, but generally only under laboratory conditions. The majority of general service transmitters are not at present capable of this constancy, and it must be some time before such constancy can be relied upon from all but very low-power portable apparatus. In particular, the "frequency drift" which takes places when starting a transmitter equipped with an ordinary type of valve oscillator may be very serious, sometimes amounting to 50 kc.

Most Government Departments controlling radio in various countries, and also the larger commercial concerns, have set up checking stations wherein the frequency of any transmitter within range may be measured against a standard clock to an accuracy at least as high as 1 in 100,000. The interference problem on short waves is complicated by the fact that a very small station can, under certain conditions, produce almost world-wide interference. "Beams" are undoubtedly of the greatest service in concentrating the energy radiated into the required direction, but small amounts of energy are radiated in other directions due to secondary beams (or tails) and also, apparently, radiation is scattered from the place where the beam enters the Heaviside layer.[2] These small amounts of energy travel with very little attenuation under certain conditions; hence directional working cannot be entirely relied upon to prevent interference, though it may be very useful.

Summing up the case of short-wave telegraph stations, there is room for an immense number of stations if the present technique is merely developed along existing lines.

The Broadcast Band

The position in the broadcasting band is, however, entirely different. One might limit the range of interference partly by suitable design of aerial, though the cost is rather high[3], but no advance along present lines will succeed in placing many more stations in the broadcast band than those already existing. The possibility of television makes the situation much more acute, for to send an adequate number of images per second with sufficient detail very high modulation frequencies are essential. Thus the recent experimental demonstration of the H.M.V. Gramophone Co., Ltd., at the Physical Society's Exhibition[4] required five channels, each of frequencies up to 20,000 cycles. If five radio transmitters had been modulated in the normal manner, a total band 200,000 cycles wide would therefore have been taken up by the transmission!

Methods of Relief

Various novel methods have been suggested at various times for overcoming these fundamental difficulties. One required the carrier frequency to be modulated instead of its amplitude, but the idea is most difficult to visualise and its mathematical treatment is also somewhat involved, while it has been shown by Carson[5] and others that the frequency band would be at least as wide as that produced by modulating in the ordinary manner, and the system would inherently distort the modulation because the higher frequencies would not be produced at their proper values.

A method which reduces the band required to half the normal is known as the "suppressed carrier single side-band system," and is actually in use. It results in a considerable saving of power, since normally two-thirds of the energy radiated is in the carrier wave, and the system appears to be very attractive, but there are many difficulties in applying it to broadcasting. Every receiver would have to be equipped with a very constant oscillator, properly adjusted; the signal heard would then be amply good enough for "commercial speech," but not of the high quality essential for entertainment purposes, one reason being that the received signal would not be a perfect copy of the transmitted signal unless the phase of the re-introduced carrier were correct. The system has been examined in considerable detail by Ladner.[6]

A method which has been adopted with some success in certain cases is the "common frequency system[7]," but the service areas of such stations are limited to areas near each station wherein the signals from other stations are "swamped" by the local signal.

Special Receivers

Another method of attack is by attempting to design special receivers. The ordinary broadcast receiver has its tuned circuits so designed that a sufficient band of frequencies is admitted to allow of the higher modulation frequencies reaching the detector. The tuned circuits should preferably have a "flat-topped" frequency-response curve in order that unwanted signals having frequencies just outside the required modulation frequencies may be rejected. The "Stenode" tuned circuits are made much more selective than this in order that unwanted signals very near in frequency to the wanted signal may be rejected. This results, of course, in all the higher tones of the wanted signal being also very greatly reduced, but is counterbalanced by using a special amplifier after the detector to magnify the higher frequencies much more than the lower ones. Then the overall frequency-response curve of the receiver can be made approximately uniform over the range of modulation frequencies required with reasonably good quality.

Consideration will, however, reveal a serious objection. There appears to be no reason why the modulation-frequency amplifier which restores the greatly attenuated higher modulation frequencies to their correct proportions should not also raise unwanted signals, which were attenuated in the specially selective high-frequency circuits, up to their original strength. If this be so, then the device is evidently useless. Dr. J. Robinson's explanation[8] of the working of his receiver is unconvincing. He takes exception to the ordinary side-band explanation and prefers to consider modulation as producing a set of transient conditions, which is quite legitimate, though the method is difficult to visualise, and even more difficult to extract numerical results from. His arguments appear to lead to the same results as the side-band theory, but to go no further towards explaining away the objection set forth above. Regarding the overcrowding problem, our conclusions therefore are that steady improvement along existing lines is being made, but the art still awaits an original solution.

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[1] Chairman's address, Wireless Section, J.I.E.E., Vol. 69, p. 11, Rickard.

[2] Investigation of short waves, J.I.E.E., Vol. 67, p. 992, T. L. Eckersley.

[3] Design of transmitting aerials for broadcasting stations, J.I.E.E., Vol. 67, p. 507, P. P. Eckersley, T. L. Eckersley, H. L. Kirke.

[4] ELEC. REV., January 16th, 1931, pp. 122-3.

[5] Notes on theory of modulation, J.I.R.E., 1922, 10 57-64, Carson.

[6] Study of wave synthesis by mechanical means, *Marconi Review*, 1929, June, July, Aug., A. W. Ladner (see also Science Museum exhibits at South Kensington).

[7] Operating several broadcasting stations on same wavelength, J.I.E.E., Vol. 67, p. 772, P. P. Eckersley, A. B. Howe.

[8] The "Stenode," *Wireless World*, Jan. 7th, 1931, J. Robinson.

Rural Distribution Problems. By T. C. Gilbert, A.M.I.E.E.

Risks from leakage-voltages are greater than under urban conditions

ABOUT twenty-five years ago the Rheinisch-Westfalisches Elektriziatswerk (R.W.E.), now the largest supply undertaking in Europe, commenced distribution in rural areas in Germany on lines very similar to those now being adopted in Great Britain. Supply was given to many farms, small and large, and development proceeded, until after a short period a rather disagreeable reaction took place owing to accidents directly attributable to the inefficiency of the protective measures which were actually cited by the company as being in many cases the causes of the accidents. These measures are identical with those employed in our own country for the protection of consumers in rural areas against leakage voltages. The voltage of the supply was similar to our own, 380/220 volts; the rejected methods of protection were earthing, both local and general, and the connection of the framework of consumers' apparatus to the neutral conductor. Investigations were made and new methods of protection devised. In the words of Direktor O. Heinisch, of the R.W.E., "We were *forced* to seek new ways to secure safety to man and beast and although the first apparatus made by ourselves was extremely simple, yet in the years that followed experience proved the principles to be right." The use of the special protective devices referred to is now compulsory throughout the vast distributions systems of the R.W.E.

Mr. T. C. Gilbert is an electrical contractor who has played a leading part in matters relating to the safety of the consumer *(Photograph by M. Wheeler, Folkestone)*

Some months ago an article* by the present writer dealt with the principles and application of protective devices as used by the R.W.E. on consumers' premises. The necessity for their employment was then clearly set out, especially in connection with the use of portable apparatus, where it is considered that the greatest risk lies, especially in rural areas. In this article the intention is to confine attention to the protection of low-voltage overhead lines and the heavier connected apparatus, with the ultimate object of reducing the risk from leakage voltages at sub-stations and consumers' installations in rural areas. Such leakage voltages readily occur in these situations due to faults on overhead lines from one of the following causes or a combination of them:—

(*a*) Preakage or disconnection of neutral conductor.
(*b*) Breakage of a phase conductor.
(*c*) Contact between two phase conductors.
(*d*) Contact between phase and neutral conductor.
(*e*) Contact between a phase conductor and earth.

Any of these faults may have serious consequences, particularly when they cause a high potential upon the neutral conductor, and that conductor is not insulated everywhere within reach, or where sub-station switchgear and consumer's appliances are connected to the neutral conductor.

Maximum Neutral Voltage Permissible

In the experience of the R.W.E., the generally accepted method of protection in Great Britain, that of earthing the neutral conductor, is by itself incapable of effecting such protection, and its inadequacy has led to the adoption of the special protective devices described later.

For reasons that were set out in the earlier article, consumers should not be exposed to a higher leakage voltage risk than 40 volts a.c., but for simplicity in calculation it will be assumed that it is desired to prevent the neutral conductor, and therefore connected apparatus, reaching a potential in excess of 50 volts above earth at any time. It will be obvious that the occurrence of several of the line faults mentioned above may result in the supply of too high a pressure to consumers' appliances, especially if single-phase, with consequent damage, but space considerations compel attention to be limited to the neutral conductor. This pressure (50 volts) is much in excess of that considered permissible by the R.W.E., whose protective devices are set for operation in some cases as soon as the neutral potential exceeds 20 volts. The action in all cases is slightly delayed, so that momentary disturbances that present no real risk do not unnecessarily isolate the affected circuit.

In view of the fact that even 20 volts can, in the experience of Continental technicians, present serious risks where cattle are concerned, it would appear advisable to prevent the neutral voltage, with its connected apparatus, from exceeding this value. Practical considerations, however, such as the length and cross-sectional area of the neutral conductor, and the existence of unbalanced loads, have led to the adoption of the 50 volt maximum in most cases, although this potential is decidedly within the dangerous pressures category.

Before proceeding to consider the special protective measures adopted by the R.W.E., it would be interesting to examine the directions in which both earthing by ordinary methods and connection to the neutral fail to secure the necessary degree of protection for consumers in rural areas.

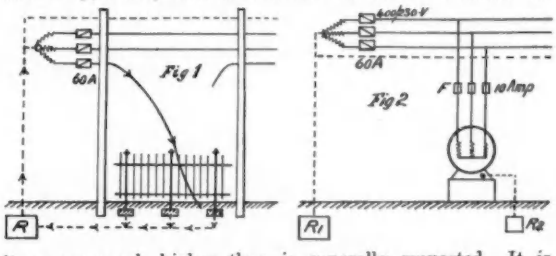
First, then, we will consider earthing, both as it affects the sub-station and the consumer's heavier apparatus, the lighter and portable appliances at the consumer's installation having already been fairly fully discussed in the previous article on the "Prevention of Accidents." The principles involved are similar and aim at the complete isolation of the circuit or appliance as soon as undesirable potentials appear where they are likely to prove dangerous to the consumer.

Earthing the Neutral

At the sub-stations, arrangements are usually as shown in fig. 1, the neutral point of the low-voltage side being earthed and the phase lines protected against overload only by fuses or circuit breakers. In some cases the metal-clad switchgear is connected to the neutral for protection against leakage voltage.

Assuming a contact between a phase line and earth, indicated in the diagram by a fallen line on an iron fence (although this may be equally well represented by a stay-wire or an iron building), and 60-A rating of fuses, then if the neutral conductor and the station switchgear is not to obtain a higher potential than 50 volts the resistance of the ground connection R must not exceed a certain value. In the case given above this value will be $50/60\times2.5=0.33$ ohm, and, obviously, the higher the fuse rating the lower must be the value of R; in the case of a fuse rating of 100 amperes it must not exceed 0.2 ohm, or the isolation of the faulty line cannot be effected. This entails the existence of a considerable risk until the fault is located and repaired.

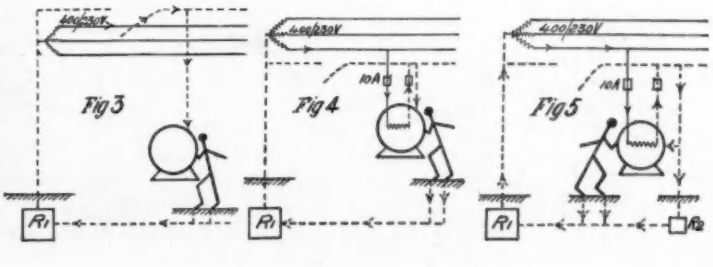
It is difficult, if not impossible, to secure earth connections of such low resistance values in rural areas, where underground cable networks or extensive water supplies are non-existent. In rocky or sandy soils the effective resistances of earth plates or pipes are often of the order of 25-40 ohms, and even in apparently favourable situations earth resistances are often very much higher than is generally suspected. It is significant to note that by the Canadian Electrical Code resistances of earth connections other than public water-supply systems are expected to rank as high as 20-25 ohms, and this value is, in fact, permitted.



Although the expenditure of considerable time and money may result in reducing the resistance of the earth connection to below 10 ohms, yet anything entailing considerable expense is usually taboo in rural electrification schemes, and earth connections are too often of the iron-rod-or-pipe-in-ditch pattern, which will invariably prove ineffective in emergency.

The difficulty is further emphasised when the consumer's installation is considered. In fig. 2 is shown a 3-phase motor as used on farms, protected against overload by the fuses F. Assuming the motor to be of 5 h.p., the fuses will be of a rated capacity of 10 amperes at least.

To ensure that the potential of the motor-frame cannot exceed 50 volts, due to leakage, the resistance of its local earth connection R_2 must not exceed $50/10\times2.5=2$ ohms, an almost impossibly low value for earth resistance on consumers' premises in country districts. As in the first instance, the higher the motor h.p., and consequently the fuse rating, then



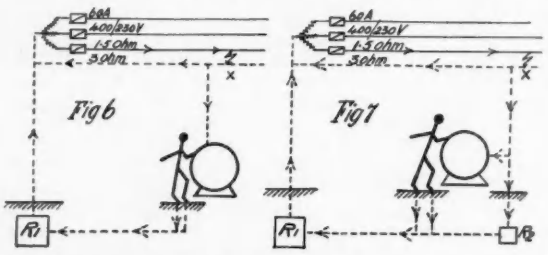
* "Prevention of Accidents." ELEC. REV., November 7th, 14th, and 21st, 1930.

the lower must be the value of resistance R_2, ignoring any resistance at R_1.

Connection to Neutral

It would be expected in practice that where direct-on-line starters or switch-fuses only are used, the rating of the fuses, even for a 5-h.p. motor, would be more likely to approach a 25-A rating. Also, in farm or similar installations, only unskilled labour is usually available for fuse renewals; it can never be safely assumed that the fuses are of the correct rating and earthing can afford no protection, but may, in fact, become an actual menace. This fact has now been recognised in some quarters, and earthing has been abandoned in favour of the connection of the framework of consumers' appliances to the neutral conductor for protection against dangerous leakage voltages, this neutral conductor being earthed at the transformer stations.

Local earthing of consumers' appliances, although inadequate, reduces the liability of disturbances in the overhead lines to cause dangerous conditions to occur at such protected apparatus, any risks which arise being due to defects in the apparatus itself. With connection to the neutral, however, faults in the distribution system are practically certain to give rise to unwanted high potentials upon the casings of the protected apparatus, the magnitude of these potentials depending upon a variety of factors, such as the loading and cross-sectional area of the neutral and phase conductors, length of line between the transformer station and the consumer's in-



stallation, and the existence of unbalanced loads. It has been found difficult to prevent this by the installation of overload protective devices only, whether at transformer stations or consumers' installations, and by earthing the neutral at the sub-stations and/or the consumers' installations.

The neutral conductor is probably the most vulnerable of the low-voltage lines, as it is generally of smaller cross-sectional area than the phase lines, sometimes being only one-half, and more junctions and tappings are made to this line than to the phase lines. The effect of a break in the neutral conductor upon all apparatus connected to it for protection against leakage voltages will, therefore, be first considered, in cases where local earthing is, and is not, resorted to in addition.

In fig. 3 is indicated a break in the neutral conductor, suspended above the phase lines, which has fallen upon a phase line.

Failure of Isolating Devices

It is generally assumed that in a case of this sort isolation will be immediately effected by the fuse, or other overload protection, in the phase line at the sub-station, and this may be the case when such a fault occurs fairly near the sub-station. It has been found in practice, however, that the resistance of the earth connection R is generally sufficient to preclude this, especially if there is any considerable length of line involved in addition. Assuming the sub-station fuse to be rated at 60 amperes, the neutral line resistance at 2 ohms and the phase line at 1 ohm, and the very reasonable figure of 3 ohms for the earth resistance R, then isolation cannot be effected; this is also the case even if negligible line resistance is involved.

The effect of a break or disconnection in the neutral with the line falling clear of the phase conductor is shown in fig. 4, where equally dangerous conditions arise, as in the former case, for all apparatus involved beyond the break. It might even be stated that the risk is increased, for in the case in fig. 3 the leakage potential upon the protected casings is possibly slightly reduced by the passage of leakage current over the phase and neutral conductors, but in the case indicated in fig. 4 the full line voltage above earth is extended to *all* connected metallic casings of protected apparatus as soon as *one* lamp or *one* motor is switched on in the affected area.

Local Earthing and Neutral Connection

Conditions are only very slightly bettered by the addition of local earthing as shown in fig. 5, as we have practically an identical set of conditions as shown in fig. 2, that is, low resistance fault to the motor frame with high resistance earth connections at R_2. Complete isolation of the motor by its own local fuses is haruly possible, as the fuse mainly concerned, that in the neutral, is shorted out by the protective neutral connection, even assuming such a fuse to have been installed.

If a third protective wire to the neutral is not utilised, and reliance is placed upon the unfused neutral return from the appliance, connected also to its framework, then a grave risk is introduced, even under normal conditions, without an overhead line fault. The simple breakage of the neutral conductor on the consumer's appliance (and this may be a flexible cord on portable apparatus) will result in the full line voltage being extended to the casing.

The effect of a contact between phase and neutral lines is shown in figs. 6 and 7; in fig. 6, where simple connection to the neutral is made, it will be seen that isolation of the affected line by the sub-station fuses is prevented by the line resistances involved.

Assuming the phase line resistance to be 1.5 ohms and the neutral 3 ohms, the maximum current that can flow will be $230/(3+1.5)=51$ amperes, whereas with fuses rated at 60 amperes this current must be at least 120 amperes to effect isolation. To obtain this the line resistances must be as low as 0.6 and 1.2 ohms respectively, ignoring all inductive or reactive effects. If isolation is not effected, then a potential of approximately 76 volts remains indefinitely upon the casing of the protected motor.

"Protection" the Cause of Accidents

It will be doubtful if we can rely upon disconnection in this case, even if the full line current of 60 amperes is flowing in addition to the fault current, if the overload protection at the sub-station is by means of fuses; if thermal overload devices are used, isolation may possibly be effected.

In fig. 7 local earthing in addition to connection to the neutral has been resorted to, but it will be seen that still reasonably safe conditions have not been secured. Simple calculations will show that even with the two parallel paths provided for the return of the fault current, isolation of the affected line cannot be secured under the conditions indicated. A high leakage potential, therefore, remains upon the protected motor casing as in the previous examples. Assuming the very low values of 2 and 7 ohms respectively, for R_1 and R_2, and with line and neutral resistances as before, 1.5 ohms and 3 ohms, the fault current cannot rise above 70 amperes, obviously insufficient to effect isolation of the circuit by itself.

These few brief examples of the commoner line faults will serve to show that connection to the neutral can hardly be considered a protective device in the proper sense of the word, and our Continental friends appear to be quite justified in their contention that this method of protection has actually been the *cause* of many accidents in rural areas. There are, of course, many other conditions that are capable of setting up similar undesirable potentials at consumers' apparatus, for instance, unbalanced loads on long lines, even under otherwise normal conditions without the presence of faults.

Every one of the examples cited above has been, in the opinion of the large supply undertaking concerned, the cause of many accidents. Fuller details of these accidents are generally freely given to interested engineers, although for obvious reasons they are not broadcast.

Underground Railway Signalling

Modernisation in London and Reconstruction of Hammersmith Cabin

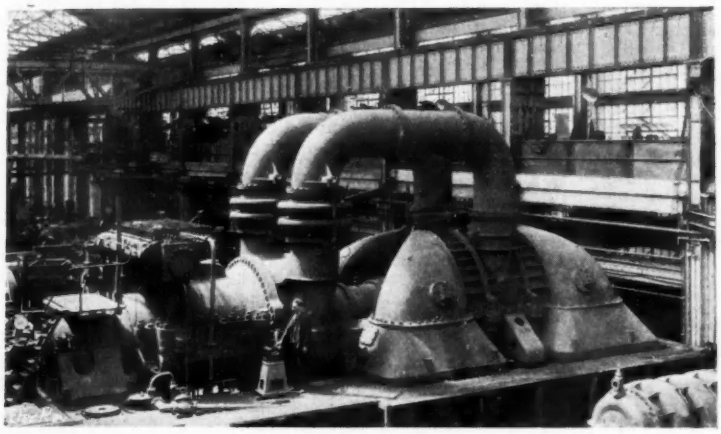
AN extensive programme of modernisation of signalling equipment has been in progress on the London Underground electric railways for some time; the work includes (1) the replacement of the original direct-current track circuit apparatus by alternating-current apparatus of the condenser-fed type; (2) provision of circuit-breaker boxes on train stops and wiring alterations to prove that signals and train stops have correctly operated; (3) complete overhaul of power interlocking frames, including replacement of all contacts by an entirely new and improved type; and (4) the re-wiring of relay rooms and in a number of cases the installation of new-type metal relay racks.

In connection with the western extension of the Piccadilly line and the consequent alterations to the platforms at Hammersmith, the old signal cabin had to be dispensed with and a new one provided. The building is a two-storey construction, the top floor comprising the signal cabin and the lower portion being used as a relay room. The frame casing has been extended to form a booking desk and also to accommodate the telephone switchboard. The switchboard for the various signalling main cables is in the signal cabin portion of the building, but no live parts are exposed. The back of the board with the connections is in the adjacent linesmen's depot and is covered over by a cabinet. The obviation of live parts in the cabin is made possible by the provision of "back of board" switches with operating handles on the front, specially made by the General Electric Company, Ltd., which firm has also developed for the Underground Company a special change-over switch. In the lower portion of the board four circuit breakers of the "Igranic" type have been provided for the cabin transformers and ring mains. In the event of any of these being tripped the signalman is able to reset them, but he cannot trip them. The relays on the shelves are of different colours, in accordance with a standard scheme adopted by this company, so that a relay can be immediately recognised as to its operating voltage, and class, *i.e.*, track, line, or point indication. The work of changing over from the old cabin to the new one was carried out in one night of about six hours without any delay or rearrangement of railway traffic. All the work was carried out by the London Underground Company's own staff.

Summer Meeting of the I.E.E. (South Midland Centre)

Members inspect turbo-alternators for capital stations and transformers for the grid and hear a lecture on talking-picture apparatus

THE South Midland Centre of the Institution of Electrical Engineers held its summer meeting on Thursday, July 2nd. About 120 members and friends took part and in the afternoon the Rugby works of the British Thomson-Houston Co., Ltd., were visited. Small parties were conducted round the various departments by Mr. A. P. Young (manager, Rugby works), and other officials of the company.



In the turbine shop the most striking exhibit was the 50,000-kW two-cylinder turbine (shown in the accompanying illustration) for the Ironbridge power station of the West Midlands J.E.A., which was under steam on the test bed. It looked a compact machine for its output. Its alternator is being built up on site (ELECTRICAL REVIEW, May 25th, p. 908), a method of assembly rendered feasible by its fabricated construction. We noticed, by the way, that the use of fabricated steel sections for electrical machinery instead of castings has been adopted to a considerable extent at these works.

Many other large turbo-sets are in less advanced stages of manufacture, such as the 67,200-kW three-cylinder turbo-alternator for the Battersea station of the London Power Co. and the two 75,000-kW three-cylinder sets for Barking (County of London Co.)—the largest yet ordered in Great Britain—as well as smaller turbo-alternators which until yesterday would have been regarded as "monsters." These include 3,000-r.p.m. sets of 30,000 kW for Spondon (Derby & Notts Co.), 25,000-kW for Brimsdown ("North-Met" Co.), 15,000-kW for Thorpe (Norwich Corporation), and also two (25-cycle) for the L.C.C. Tramways.

Quite out of the ordinary run of things is the 30,000-kW 3,000-r.p.m. three-cylinder impulse-type turbo-alternator for the Dagenham factory of the Ford Motor Co., which has been designed for steam conditions of 1,200 lb. per sq. in. and 725 deg. F. Vacuum is to be 29 in. Steam leaves the high-pressure cylinder at 200 lb. per sq. in. gauge, and part is reheated to a total temperature of 550 deg. F. The remainder will be used for process work. Other turbines of smaller capacities are being manufactured for the same firm.

Mention should be made of the turbo-alternators, propeller motors, &c., for the 20-knot s.s. *Rangatira* for service between Wellington and Lyttleton, N.Z., and also of the seven 1,300-kW combined turbine and condenser auxiliary generators for the giant Cunarder *Princess Elizabeth* now being built at Clydebank by John Brown & Co.

Turbine Wheel Testing

The turbine-wheel testing plant is a new departure and is the first of its kind in this country. Its purpose is to ascertain the possible nodal frequency of vibration of wheels at various speeds. If the nodal frequency should occur at the running speed of the unit, the backward running wave of the wheel is travelling as fast as the wheel but in the contrary sense; the wave then becomes stationary in space and can build up a frequency of such an amplitude as to cause damage. By means of the apparatus referred to the speeds at which major vibrations occur (*i.e.*, when the wave is stationary in space) can be ascertained. The casing is made of forged steel and overheating is prevented by the circulation of steam; the wheel is driven by an external steam turbine. Two sets of exploring coils within the machine transmit to two oscillographs electrical indications of the movement of the wheel under test.

Power Transformers

We next saw three-phase transformers in various stages of completion, ranging from 2,000 kVA at 33 kV to 60,000 kVA at 132 kV for the North West England Area of the grid. The latter size contains 35 tons of transformer iron, and its coils are very noticeably large in diameter—the lengths being definitely limited by considerations of transport. Great interest was shown by the visitors in the on-load tap-changing equipment; for the larger higher-voltage transformers this is of the double-ratio adjuster type and for the small medium-voltage transformers of the drum-controller type, the tappings are brought out in pairs on either side of the magnetic centre of the windings so as to minimise the mechanical stresses set up under abnormal conditions. All disk coils without tapping are wound without joints between sections. When the end of a drum is reached the copper is electrically welded to that on the next drum to be used. In all cases the coils are given a final vacuum oil impregnation. Several grid transformers such as the 20,000-kVA 132/6.6-kV unit illustrated were seen with separate radiator banks for heat tests.

Of exceptional interest was one of the 132-kV potential transformers for the grid (described in our last issue, p. 20). These transformers are designed and manufactured in the same way as small power transformers.

Rectifiers for Railways

The rectifiers in production in the large electrical machine shop include 17 of 1,500 kW and 5 of 2,000 kW for the London Electric Railway and two of 1,200 kW for the Barking-Upminster electrification of the L.M.S. Railway. These are similar to others in operation on the tubes and on the Altrincham railway (ELECTRICAL REVIEW, January 23rd and May 15th, 1931). The tubes and the Metropolitan Railway between them have also ordered 153 sets of automatic electro magnetic control equipments—very striking looking pieces of apparatus—while the growing popularity of the trolley 'bus has called for others of a different type which include rheostatic braking in their design.

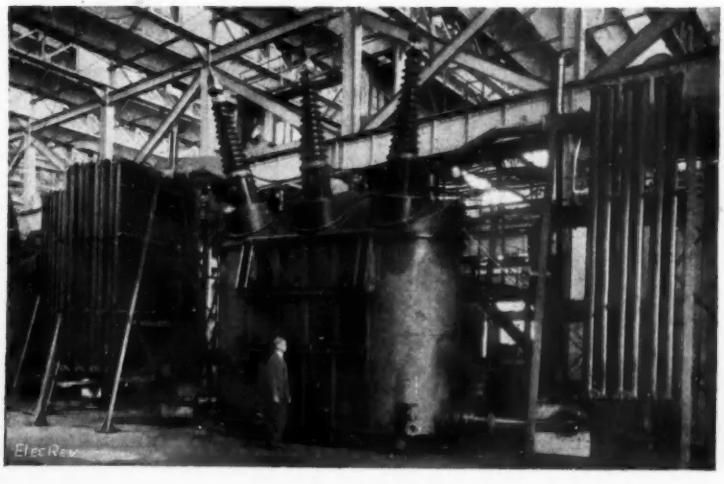
The fourth high-voltage d.c. motor generator to be ordered by the G.P.O. for its Rugby radio station is nearly ready for use in the new telephony transmitter. It is of 500 kW capacity and consists of five machines mounted on an insulated base-plate, two of which are 6,000-V d.c. generators (each with a single commutator) connected in series. Provision is to be made for running the unit in series with one of the existing 6,000-V generators to give 18,000 V to earth.

The Engineering Laboratory

The laboratory comprises 34 rooms on two floors of a building 180 ft. long and 50 ft. wide. The work carried out can be classified under three heads: (1) general electrical, dealing with miscellaneous electrical and magnetic problems, noise analysis, iron tests, loud-speakers, h.v. condensers for power-factor and small phase-angle investigations, and vacuum physics; (2) insulation, concerned with the technical control and improvement of manufacturing progresses; and (3) chemical and metallurgical, which also covers lubricating oils, centrifugal castings, forgings, and protective coatings. The equipments of the laboratories are in many cases small replicas of the ordinary works plant.

The latter part of the programme consisted of a masterly lecture on the Growth and Development of Talking Pictures by Mr. R. C. Clinker, followed by a demonstration of talking picture apparatus in the company's acoustical theatre.

Further particulars of the summer meeting will be found in our "Personal" column.



The Faraday Centenary

An Appreciative Tribute to the Electrical Pioneer

WITH his discovery of electromagnetic induction on August 29th, 1831, Michael Faraday literally created the industry of electrical engineering. This discovery may therefore be considered one of the greatest in the history of science, and in view of the extensive preparations now being made for its appropriate recognition the appearance of Commander Appleyard's book* is particularly opportune. The question whether a new book on Faraday was really needed may well be raised if we consider past writings. The first, and probably most authoritative work dealing specifically with Faraday's life was the "Life and Letters" by Bence Jones, published in two volumes 8vo. in 1868, and now long out of print. In the same year appeared John Tyndall's "Faraday as a Discoverer," a most lucid and instructive account of the researches and also the character of Faraday such as only Professor Tyndall could write. This work saw five editions before going out of print. In 1872 appeared Dr. J. Hall Gladstone's "Michael Faraday," which contained a valuable moral and religious appreciation. Revised editions of this work, which is now out of print, were issued in 1873 and 1874. All these authors were friends of Faraday and therefore had intimate personal knowledge of their subject—an important qualification for writers of biography. They were not, however, in a position to assess, at the time of their writings, the real worth of Faraday's researches. This task was admirably carried out by Professor S. P. Thompson in his "Michael Faraday: His Life and Work," which was published in 1898 and is undoubtedly the most instructive of the accounts of Faraday's electrical researches. It contains extensive references to Faraday's scientific work, together with extracts from his notebooks. A further biography is given in A. Laccari's "La Vita di Michele Faraday," published at Cordova in 1908. Among briefer biographies are John Tyndall's article "Faraday" in the Dictionary of National Biography; the article "Faraday" by James Clerk Maxwell in the "Encyclopædia Britannica"; the chapter devoted to Faraday in Dr. W. Garnett's "Heroes of Science"; and the "Eloge Historique," by M. Dumas.

A Modern Biographer

A modern biographer has a wealth of existing material to draw from when original sources are not available. The scope of Captain Appleyard's book is ambitious, since we learn from the preface that it includes "the story of his parentage, his environment, his mode of thought and operation, his sympathies, his difficulties, his victories, and his passion for truth." One is led to expect much new material, and this expectation is largely realised throughout the book.

The first six chapters are concerned with Faraday's parentage, his birth, and subsequent career, and we learn that, "with few exceptions, the recorded personal details concerning him are singularly devoid of cohefence." Our author is nevertheless able to give a very complete account of the family, and as the result of his successful visit to the Yorkshire homestead of the Faradays in search of further information he is able to record many interesting details. There follows a brief account of Faraday's apprenticeship to a bookbinder, but the absence of any reference to the source of information for this important part of his life makes it impossible for any interested student to extend his reading to the original sources. The obligations in the matter of references applying to any non-contemporary biographies are sufficiently obvious to have been recognised in all such sections of the book. We are told how Mr. Dance, "one of the customers at the book-shop," took Faraday "in February, March, and April, 1812 . . . to hear on four occasions Sir Humphry Davy at the Royal Institution." It would have been quite easy to state the actual dates of these lectures, which are given in Tyndall's D.N.B. article as 29th Feb., 14th March, 8th and 10th April; together with the information that Mr. Dance was a member of the Royal Institution.

In a comprehensive account of Faraday's tour through Europe from October, 1813, to April, 1815, as the companion of Sir Humphry and Lady Davy, our author remarks upon the fact that, in spite of the strained relations between France and England, Davy obtained safe-conduct to visit enemy countries, and he contemplates "whether it would be more correct to ascribe this to the astuteness or to the magnanimity of Napoleon." This point received attention from Libby in his *Introduction to the History of Science*, wherein reference is made to Napoleon's award of a medal to Davy in recognition of his paper on "Some Chemical Agencies of Electricity," which was read before the Royal Society in 1806. This action of Napoleon, at a time when we were at war with him, gives a true perspective of his character, as distinct from the warped view conveyed by history books, which is, perhaps, responsible for the lack of recognition of Napoleon's greatness. The biographical sketch of Sir Humphry and Lady Davy in this part of the book is particularly good.

Activities and Correspondence

After touching upon the unpleasant details of Faraday's state pension, which occasioned so much ill feeling, our author concludes his story of Faraday's life with an admirable sketch of his various activities, illustrated with extracts from his correspondence and from contemporary publications, which give an excellent perspective of Faraday's character. In Chapter VII are set out Faraday's views on the teaching of science in schools, and one is surprised at his grasp of fundamental defects in educational systems which might very well apply to the present day . . . . . "persons who have been fully educated by the present system . . . . . are ignorant of their ignorance at the end of all that education . . . . . they want the ABC of science, and not the XYZ . . . . . they want the first elements. The ordinary schoolmaster does not know it . . . . . Lectures depend entirely for their value upon the manner in which they are given. It is not the matter, it is not the subject, so much as the man. Teachers have never recognised its value. . . . . "

The remaining eight chapters are concerned with Faraday's experimental researches; his notebooks, correspondence, and commonplace books. In this section one becomes conscious of the author's difficulties in presenting a consistent account of Faraday's researches. The statement, on page 82, that the mind of Faraday was "in the highest degree imaginative" is very misleading, since careful avoidance of speculation was a characteristic of all his work.

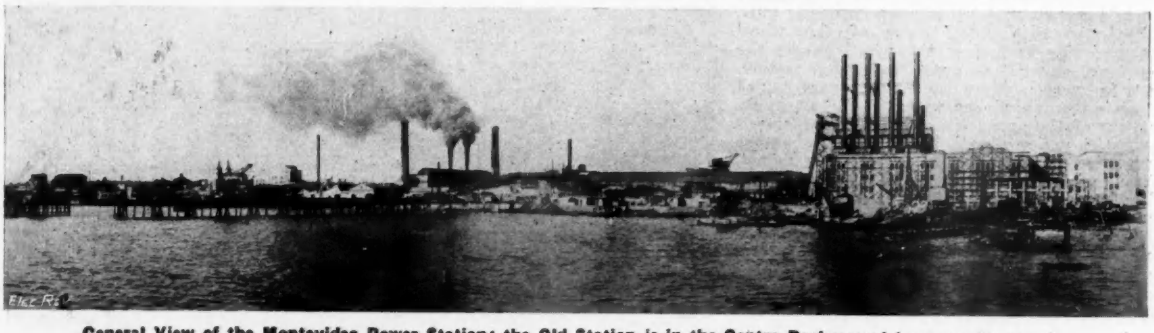
One is told on page 96 that "in his constant effort to free his language from ambiguity, Faraday developed remarkable onomastic power. His designations entered into the literature and parlance of the electricians of the world," but it should be pointed out that Faraday received great assistance from William Whewell, Master of Trinity College, Cambridge, in connection with terminology. Whewell was probably the greatest living expert on scientific terminology and the words *anode*, *cathode*, *anion*, *cation*, and *electrolyte* were derived from the Greek by Whewell and suggested by him to Faraday.

Interesting selections are included from Faraday's correspondence, primarily with Maxwell and Kelvin in connection with electrical researches and the experimental work of Julius Plücker, of Bonn, on magneto-crystallic action. The circumstances leading up to the discovery of electromagnetic induction in 1831 are carefully described, and the work of Galvani, Volta, Arago, and Ampére is touched upon. There is no reference to the extension of Ampére's work at the hands of Weber, Riemann, F. E. Neumann, and Clausius, who, with Maxwell, represent the founders of the mathematical theory of electricity and magnetism.

Commander Appleyard brings his book to a close with a reference to Faraday's indifference to wealth. While it may be that this circumstance arose partly from the smallness of his official emoluments, there is abundant evidence that he chose to give to the world his great discoveries, not for monetary gain, but for the honour and furtherance of scientific knowledge.

The book presents a very true picture of Faraday's life and times, the progress of his scientific interests, and the importance of his discoveries. It should be in the possession of all those interested in the history of science and the great part which England has played in scientific progress.

* *A Tribute to Michael Faraday*, by Rollo Appleyard Pp. 204 +xiii+26 illustrations. London: Constable & Co., Ltd., 1931. Price 7s. 6d. net.



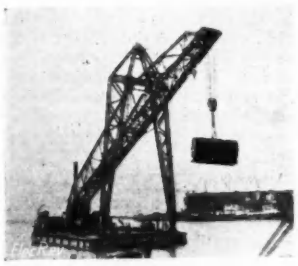
General View of the Montevideo Power Station; the Old Station is in the Centre Background *(see opposite page)*

The Montevideo Power Station

The half-million inhabitants of the capital of the Republic of Uruguay are now well served electrically

THE first instalment of plant at the new Montevideo power station consists of two 31,250-kVA turbo-alternator sets, together with boiler house plant, &c. Provision is made for extending the station to an ultimate capacity of 120,000 kW. Although the order was placed on January 21st, 1930, the first turbo-alternator was put into commercial operation on June 8th, 1931.

Coal and oil fuel are brought to the station by barges, which are unloaded at the mole on the left of the illustration on p. 54. The main power station buildings may be seen on the right, the boiler house chimneys, rising over 200 ft. from ground level, being clearly visible. On the right of the boiler house lie the turbine house, control and switch houses, and administration offices.



The Floating Crane

The boiler house for the initial stages of the scheme is equipped with eight "CTM"-type boilers, each of 91,000 lb. per hour capacity (m.c.r.).

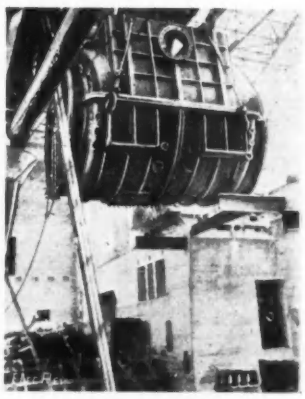
The two main turbo-alternators each comprise a 31,250-kVA (0.8 power factor), 3,000-r.p.m., 6,300-V, 3-phase, 50-cycle generator, driven by a two-cylinder tandem-type turbine equipped with multi-exhaust features. Steam conditions at the turbine stop valve are 500 lb. per sq. in. gauge, and 800 deg. F. A 750-kW, 2,200 V a.c. auxiliary generator is directly coupled to each of the main machines. The alternators are equipped with an enclosed air ventilation system, with air coolers situated in the foundation block, external fans being provided for additional circulation of the air at the higher load conditions.

In addition to the direct-coupled generators and the station auxiliary transformers, a 750-kW, 2,200-V, 3-phase, 50-cycle, emergency station turbo-alternator set is also installed for supplying power to the axiliaries. The control room which houses all the control boards for the generator switchboard, and the feeders, &c., is located on the top floor of the control building, and the various switchboards have been arranged in such a manner as to make a room within a room. Above the main panels is a "mimic" diagram, indicating all the main electrical connections, with miniature semaphores automatically operated from the various switches, giving a visual indication of the switch operation. Above this "mimic" diagram, which extends right round the inner room, is a false roof of frosted-glass of very pleasing appearance.

The power station is coupled electrically to the existing generating station by means of 15,000 yd. of interconnecting cable, consisting of 0.5 sq. in., 3-core, paper-insulated, lead covered and armoured type cable. These cables, which are laid side by side underground are necessary for transferring the power from the existing station to the various outgoing feeders, situated in the new station. For the control of the main and auxiliary switchgear, indicators, and telegraphs, &c., 35,340 yd. of multi-core cable have been used, ranging from two to twelve cores. The total amount of cable, including that required for the main alternator connections, and supplies to all the auxiliary gear in the station, is 45 miles.

The large condensers are of the single-shell type, with divided water boxes, and are arranged under the turbine, and across the foundations. The total weight of each condenser complete with tubes, water boxes, &c., is 88 tons. The installation of the condensers was carried out before they were tubed, with a view to reducing the lifting weight. The illustration depicting the hoisting of one of the condensers over the foundation blocks before threading it through the foundations indicates the small margin of space available.

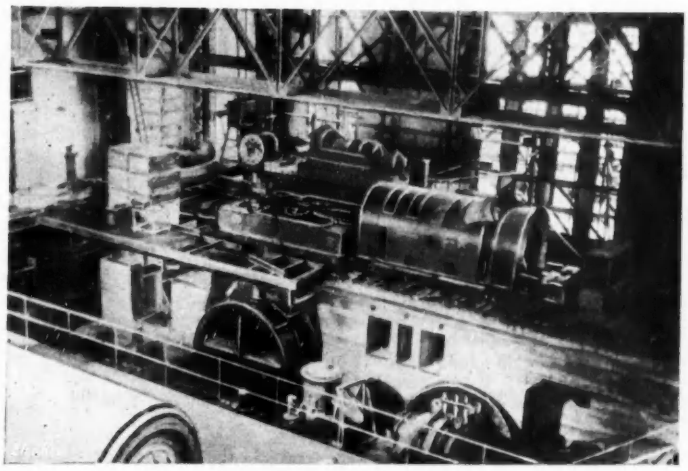
The turbo-alternator stators, each weighing 65 tons, were transported from the ship to the dock wharf by means of a huge floating crane as the wharf cranes were not large enough for the purpose. A special railway truck had to be chartered, and extreme care was necessary in the process of getting the stators from the dock side to the turbine house in the station. The above indicates one or two of the many tasks which had to be successfully overcome.



Hoisting a Condenser

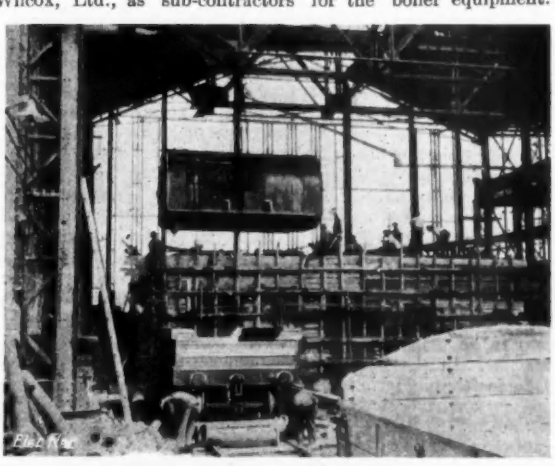
A general view of one end of the turbine house may be seen below; this also shows the turbo-alternator and condenser, &c., referred to above, in their final positions with the first portion of the turbine being installed.

The Metropolitan-Vickers Electrical Export Co., Ltd., acting as main sub-contractor to the Cia General de Obras Publicas, which did the civil engineering works, supplied all the machinery and plant for the engine room, boiler house, switchgear and control house, &c., with Messrs. Babcock and Wilcox, Ltd., as sub-contractors for the boiler equipment.



General View of Power Station

One of the Large Single-shell Condensers



Raising Stator on to Foundations

Progressive Assembly. By A. W. Willsmore, F.R.Econ.S.

Securing lower costs through improved handling methods

THE major problem facing industrial management at the present day is that of reducing costs, and one of the most fruitful sources of saving is being found in the adoption of the principles of mechanical handling. Moving is now the greater part of making in industry, and when careful time studies are prepared with a view to obtaining lower costs through improved manufacturing methods, it is usually found that a far greater time is spent on moving material and waiting for material than is spent on actual processing. Obviously, therefore, attention paid to handling methods might be expected to bring to light greater potential economies than studies made into possible improvements in actual process operations. Moreover, in addition to reducing manufacturing time and handling costs, the improvement of handling methods yields very valuable results in decreasing investment in work in process, reducing floor space requirements and improving turnover, and it is therefore a question which no efficient manufacturer can afford to ignore.

Mechanical Handling

Generally speaking, improved handling means mechanical handling, and the aspect of mechanical handling that is of the greatest interest to the electrical industry is the application of the idea to straight line or progressive assembly. Progressive assembly as developed, for instance, by Henry Ford, is more than mere mechanical handling. It is the most advanced production practice of the present day, and involves the co-ordination of all the various elements of production to ensure a steady flow of materials, piece parts and assemblies throughout the whole manufacturing cycle. Its application has been found to yield lower manufacturing costs than any other system of production, and it is a certainty that the motor car could never have reached its present stage of popularity were it not for the low prices made possible by this development of manufacturing method. The idea is not universally applicable to the electrical industry, but for many of its products the principles of progressive assembly offer the ideal manufacturing method and are now being adopted by several of the larger electrical manufacturers in this country, particularly in the telephone and domestic appliance field. The object of this article is to show that the idea can be used with equal success by the smaller manufacturing company, and that even though the volume of output may not at first sight appear to be sufficient to justify the introduction of progressive assembly, yet in actual fact it may be possible to employ the scheme with profit.

Gradual Introduction

At the outset it should be appreciated that if a concern decides to adopt the practice of progressive assembly, it does not necessarily involve itself in a complete conversion of its factory to the new method. The system can be introduced at first on one individual piece of apparatus, or type of appliance, and with the experience gained, its use can be extended later to other products where there is sufficient volume of business to justify it. In this connection it should be appreciated that there must be a steady flow of work if progressive assembly is to prove a paying proposition. The introduction of the system involves a certain increased investment in new plant, and the resultant savings must obviously be sufficient to pay the charges on the increased capital expenditure involved. In other words, a certain degree of mass production is needed for the success of the installation, and a careful study must be made of the economics of the application before any decision is taken.

For instance, a firm manufacturing domestic appliances might be considering the installation of progressive assembly equipment for the assembling of cords and attachment plugs. The studies made into the advantages of the system might indicate that it would yield a saving of .75d. per cord as compared with the existing method, and the question would be, what volume of output would be required to justify the expenditure of, say, £2,000 on reorganising the shop plant to perform this operation on a progressive assembly basis. In the first place, the concern would expect the savings to cover the usual return of, say, 10 per cent. on the investment involved or, in other words, an extra profit of £200 would have to be made on the operation to justify the additional expenses. In the second place, allowance would have to be made for the depreciation of the equipment, and the average business manager would probably expect the installation to pay for its cost in, say, three years. In summary, therefore, in addition to expecting a saving of £200 to cover investment charges, he would expect to get back the £2,000 he had spent on the outfit in three years at the rate of, say, £700 per year, so that the total saving to justify the installation would be £900 per annum.

Volume the Deciding Factor

We will assume that, in calculating the saving of ¾d. per cord, full allowance has been made for the actual running costs of the installation, and the question now resolves itself into one of how many cords must be handled a year to give a total saving of £900 with a saving of ¾d. on each cord. The answer is 288,000 cords; so the installation would be justified by an output of 288,000 cords a year or, say, 6,000 cords a week. These figure are, of course, purely hypothetical, and must not be taken as representative of any actual case, but under the conditions we have outlined the manufacturer would probably not be justified in installing a mechanical conveyor equipment for this particular operation unless he could see a load of 300,000 cords a year.

It is at this point that the average small manufacturer turns down the idea. He will argue, and probably rightly so, that he knows that on no single line has he sufficient volume of output to justify a progressive assembly system. But the whole point is, that although in many instances there is no single line handled in sufficient volume to justify the system, yet there actually may be sufficient volume to justify it on a group of lines essentially the same in manufacturing method. This point will perhaps be more clear from an actual example.

Application to Allied Lines

The American Westinghouse Electric and Manufacturing Company had found considerable savings to result from the introduction of progressive assembly methods in the manufacture of some of its more popular lines. Definite savings in assembly costs and supplementary savings in storage space and handling costs had been traced to the scheme, and it was desired to extend the system to other lines, in particular to the small domestic electrical appliances such as toasters, hot plates, and bowl-type fires. But in no one of these lines was there sufficient volume to justify the expense involved. A further study into the particular lines involved, however, showed a marked similarity of fundamental assembly operations. All of the devices concerned, for instance, had wire-wound heating elements of similar design, the principles behind the framework construction in each case were the same, the system of electrical testing was very much the same for each appliance, and all were packed in cartons of about the same size and design. As a result of these studies it was found that a conveyor could be installed over which the different types of appliances could be run consecutively at different times during the monthly production period. That is to say, toasters could be run at a rate of, say, 1,000 a day for 10 days; then bowl fires at 500 a day for 10 days; and hot plates at a similar rate for the same period, and in this way the installation "proved in" financially for the group where it would not have paid for any individual type of appliance.

This should go a long way to show that very careful investigation is necessary before a manufacturer can say point blank that progressive assembly holds out no advantages to his particular factory. Progressive assembly can be adapted to fill the needs of the small factory as much as the large, and the same results can be expected in each case in the form of minimum shop costs, reduced shop inventories, easier production planning and closer control, savings in floor space and a faster rate of output.

The Infancy of Electric Traction

The first recorded experiment in electric propulsion took place no less than 90 years ago, the *Railway Gazette* states. An inventor named Davidson, who had been responsible for some notable researches in the realm of electro-magnetism, fitted a coach 16 ft. long with propelling machinery operated by eight powerful electric magnets, and these succeeded in driving the 6-ton vehicle over 1½ miles of line on the Edinburgh and Glasgow Railway at a speed of more than 4 m.p.h. Driving wheels of only 3 ft. diam. had been provided, and after the test it was claimed that better results, and in particular higher speed, would have been obtained by the use of 4-ft. driving wheels instead of 3-ft. wheels. The test was, however, regarded as quite successful, and as it was made in 1842, it is probable that this was the first essay ever made to propel or to move vehicles by electric power. Yet over 40 years elapsed—from 1842 to 1883—before the first electrically operated railway in the British Isles, from Portrush to Bushmills, in Ulster, was brought into operation on January 18th, 1883.

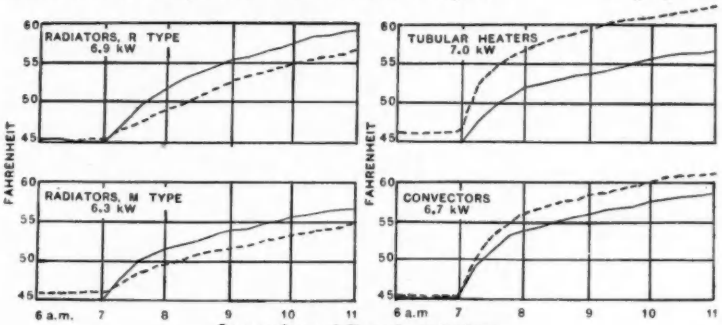
Radiant School-room Heating

A practical demonstration of the merits of an economical system

AT the summer meeting of the Institution of Heating and Ventilating Engineers at Harrogate, Mr. A. F. Dufton, M.A., D.I.C., made an exceptionally important contribution to the study of the heating of school buildings by outlining the results of the Building Research Station's comparison between different systems.

Description of Installation

The instrument used for recording the effective temperature was a eupatheoscope, and it was used for comparing the conditions obtaining in two class-rooms which the Willesden Education Committee lent at Wykeham School, Neasden, during the Christmas holidays. The class-rooms are 22 ft. 6 in. by 21 ft. 6 in. by 11 ft. high, equipped with five electric radiators composed of a ceramic material, non-luminous, 7 ft. 3 in. above the floor, and the angle at which they are fixed is designed to give a uniform horizontal intensity and to limit the vertical intensity of radiation to a suitable figure.



Comparison of Four Installations

It is, of course, important that the carefully balanced distribution of a radiant installation should not be marred by the use of only a proportion of the heaters. The heaters have a considerable thermal capacity and the intensity is controlled by a radiation thermostat. Four heaters on the desks, which emit 8,000 B.th.u. per hour, were used in some of the experiments to simulate the presence of children during school hours. Two types of radiators were available for the experiment: the M-type, as actually installed at Wykeham School, and the recently developed R-type, in which the back of the heater is insulated and is stated by the makers to emit 40 per cent. more radiation from the face for the same electrical input.

For comparative purposes tubular heaters were installed in the other class-room along the walls, under windows, and also along the back wall of the room. Experiments were also made with convection heaters; three were installed, one under each window, of a non-commercial type used at the Building Research Station as typical convectors; radiation is reduced to the practical minimum by screens covered with polished tin.

Tests in Closed Rooms

The variations induced by ventilation are of great complexity. With all the windows shut and with no thermostatic control of the heaters, the comparison of the four installations is well shown by the above set of records of a eupatheoscope approximately in the centre of the room. Effective temperature is shown by full curves and air temperature by dotted curves.

The most striking deduction is the difference between the air and effective temperatures, and it is significant that in raising the effective temperature 10 deg. F. one system raised the air temperature 9 deg. F. more than another. The variation in effective temperature at various points in the room heated with R-type radiators was 1 deg. F., and in the room with tubular heaters the maximum variation was 2¼ deg. F., the effective temperature in the centre being the average for the room.

It is, perhaps, somewhat surprising that for the same air temperature the convection heaters afforded a higher effective temperature than the tubular heaters. The explanation of this apparent anomaly appears to be that an appreciable amount of the radiant heat from the tubes goes to heat the wall just behind them to no great advantage, while considerably less heated air rises to warm the walls above the heaters. Regarding the rates at which the different installations warm a room, when allowance is made for the differences in rating at the end of one hour there is nothing to choose between the two types of radiators and the tubular heaters; the convection heaters, however, show a 30 per cent. greater rise in effective temperature. At the end of four hours the R-type radiators showed a rise 10 per cent. greater than either the M-type or the convectors and 20 per cent. greater than the tubular heaters.

Tests in Ventilated Rooms

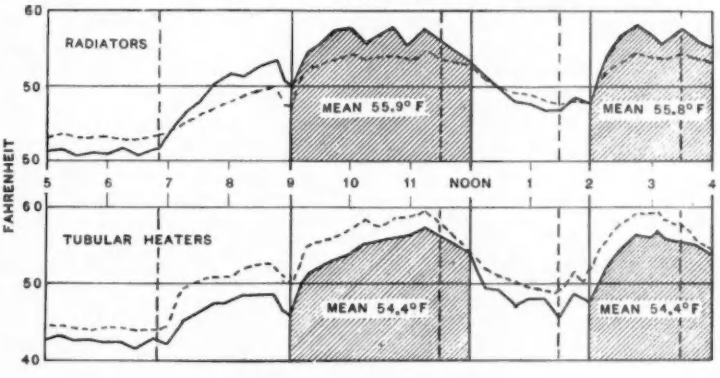
For this purpose six of the centre-hung clerestory windows in each room were opened, together with four hopper lights on the other side of the room. The records show a slight advantage of the radiators over the convectors.

Typical School Day

The ventilation was reduced to that afforded by two of the clerestory windows in each room; the radiation thermostat was adjusted to control the effective temperature at about 57-58 deg. F. and the thermostat of the tubular heaters was set to cut off at an "air" temperature of about 60 deg. F. The school hours were from 9 a.m. to noon and from 2 p.m. to 4 p.m. For ten minutes before each period the doors of the class-rooms were left open and during each period heaters simulated the presence of children.

The heating of the class-rooms was begun just before 7 a.m., in preparation for 9 o'clock, and at 1.30 p.m. in preparation for 2 o'clock. The heat was switched off at 11.30 a.m. and 3.30 p.m., that is, half an hour before the end of each period. A record obtained in this manner is shown below; the heating-up period from 7 to 9 a.m. shows the radiators to advantage. The radiators, although in a room which, at the start, was colder than the other, maintained an effective temperature about a degree and a half higher than the tubular heaters and the consumption of electricity was 15 per cent. less. The tubular heaters installed appear to be inadequate for intermittent heating in weather as cold as that recorded.

The conclusions are that the radiant system is economical, a smaller consumption of electricity providing an equal degree of warmth, which is obtained with a lower air temperature. No opinion is expressed as to the optimum temperature for a schoolroom.



Typical School Day Records

Discussion

MR. COOLING wished for the extension of the tests to large halls holding 2,000 persons where the great amount of ventilation required produced steady draughts.

MR. C. E. H. HALLETT said that heat-loss calculations might be all right for continuous heating, but comparison of the curves showed that steady conditions were very far from being reached. The effect of panelling seemed to indicate that the specific heat of the materials used was even more important than their thermal conductivity and was so great that it was of the first importance that architects should co-operate with heating engineers, for by this means more than by any other great economies in heating could be effected. The tests were carried out on a commercial installation under practical conditions and arrangements had been made for the comparison to be confirmed on a large scale by using 100 kW of each of the two systems. The annual bill would be the same with electricity at about 0.5d. per kWh and coke at 30s. ton. As the high-temperature panel system cost less to install and the labour and maintenance were also less, 0.5d. per kWh could frequently be compared with 20s. per ton.

MR. HORTON felt that they were putting the clock back by using high-temperature panels; radiation prevented the brain from working and was not healthy. He disputed the figures quoted by Mr. Hallett.

MR. PRESTON felt sure that the work outlined would have a great effect commercially. The tests should be extended.

MR. NOBBS was greatly impressed by the precision of the results and considered that the paper provided a strong incentive to support research. He hoped that the necessary money would speedily be forthcoming so that a controlled weather room could be built.

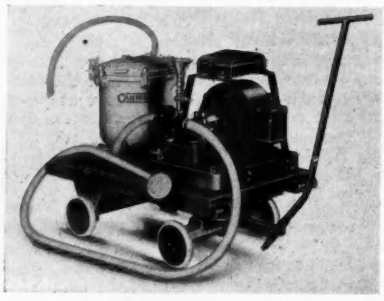
MR. CHING said that now they had the Building Research Station at Watford practical people must help by supporting the investigators and giving practical effect to their work.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Electro-plating Filtration Plant

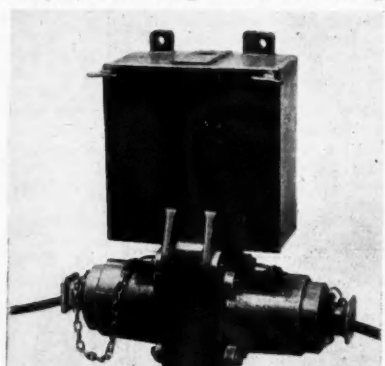
To meet the case where no filter equipment is fitted integral with the electro-plating vat, W. CANNING & CO., LTD., 133 to 137, Great Hampton Street, Birmingham, have designed two forms of portable filtration units suitable for different sizes of installations. One is motor driven and the other is hand-operated. The power outfit consists of a pump and filter chamber, with suction and delivery hose, mounted on a light truck, making a self-contained mobile outfit ready for immediate use and easily placed in position alongside any vat. The filtering head is of acid-resisting metal clamped to a container firmly bolted to the truck. The actual filtering media are attached to the head, which is easily removable for cleaning purposes. The phosphor-bronze pump has a capacity of 300 gal. per hour and is mounted on a cast-iron bedplate bolted to the truck. It is directly-coupled to a motor supplied with a suitable starter. The flexible rubber hose (for suction and delivery) is fitted with quick-acting unions, and a special rose with removable grid is provided at the suction end to prevent articles accidentally dropped into the vat being drawn into the pump. The entire solution as drawn from the plating vat is filtered as it is delivered to the storage vat, where it remains while the plating vat is being cleaned out. Alternatively, the outfit can be used for continuous filtration of the solution by placing the suction hose at the bottom of the vat at one end and introducing the delivery hose at the other end. The overall dimensions are 42 in. long, 27 in. wide, and 39 in. high. The smaller unit consists of a hand-operated pump and filter chamber, with suction and delivery hose, mounted on a light steel stand which can be carried by the operator to the desired position for working. The pump has a capacity of 100 gal. per hour, and the overall dimensions are 12 in. long, 24 in. wide, and 42 in. high.



Canning Power Filter Unit

Factory-circuits Control Box

A recent introduction of A. REYROLLE & CO., LTD., Hebburn-on-Tyne, is a "swug" control box for governing circuits in factories and other places where there is likely to be rough usage. The apparatus consists essentially of two 15-A "swugs" and a metal-clad three-phase, single-circuit fuse box. Two separate circuits may be controlled from the box, the outgoing cables being connected to the "swugs" which perform the duty of combined switches and plugs and are encased in cast metal.



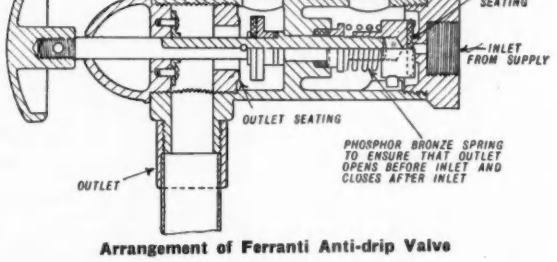
Reyrolle "Swug" Box

Device for Determining Conductor Sizes

In a recent issue of "*Revue Générale d'Electricité*," M. R. Valensi, the chief engineer of the Compagnie Generale d'Entreprises Electriques, Paris, describes a ready reckoner he has devised for quickly ascertaining the necessary sizes (section) of conductors for given electric power transmission lines. The device is based on the principal of the graphic solution of the equation giving the section of the conductor in terms of the admissible line power losses. It takes the form of three round disks working about a central pin. The largest and rearmost disk is graduated for voltages of from 100 to 300,000 V; the central disk is similarly graduated on one edge for capacities from 1 to 100,000 kW and on the other for conductor sizes (sections) from 1.2 to 1,000 sq. mm.; and the small outer disk is graduated for line lengths from 1 to 1,000 km. and for power factors of from 0.1 to 1. Part of the largest disk is also graduated to show power losses in hundredths. To use the device the disks are rotated to bring the figure denoting the pressure between the conductors opposite that representing the amount of power to be transmitted, and then setting the point denoting the p.f. opposite that representing the permitted power loss. When this is done the size (section) of conductor will be found opposite the figure representing the length of the line.

Anti-drip Water-heater Valve

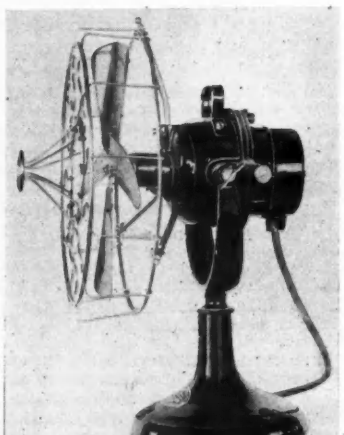
The anti-drip device which FERRANTI, LTD., Hollinwood, Lancashire, have fitted to their displacement-type water heater is in the form of a two-port valve, one port controlling the incoming cold water and the other the flow of hot water. When the valve is shut both the inlet and outlet are completely closed. On turning the handle of the valve the hot outlet pipe is opened first, allowing the expanded water to escape; then, as the valve is further turned, the cold-water inlet is opened, allowing displacement to take place, this giving a flow of hot water from the tank. On closing the valve the operation is reversed, the cold-water inlet being closed first and the hot-water outlet immediately afterwards. The device incorporates a separate expansion pipe which is always open to the atmosphere, thus ensuring that pressure cannot be generated inside the container. It is claimed that the wasteful drip of hot water is entirely prevented.


CHROMIUM PLATED HANDLE
HOT OUTLET FROM HEATER
COLD INLET TO HEATER
INLET SEATING
INLET FROM SUPPLY
OUTLET SEATING
PHOSPHOR BRONZE SPRING TO ENSURE THAT OUTLET OPENS BEFORE INLET AND CLOSES AFTER INLET
OUTLET

Arrangement of Ferranti Anti-drip Valve

Flameproof Fan

To meet the demand for an electric fan suitable for use in positions where there is a risk of explosion, such as in accommodation spaces in oil tankers, VERITYS, LTD., 31, Covent Garden, W.C.2, have designed one to withstand, without injury, any explosion that may occur within its casing, and also to prevent the transmission of flame such as would ignite any inflammable or explosive mixture in the surrounding atmosphere. A certificate issued by the Mining Department of Sheffield University shows that a sample submitted for test meets the requirements of the appropriate B.E.S.A. specification. The fan is fitted with ball bearings and is grease lubricated, the bearings holding sufficient grease for a year's running. The body is finished in black or white enamel, relieved with gold. The loading is 58 W, the speed 1,370 r.p.m., and the weight 31 lb. Models can be supplied for both d.c. and a.c. supplies.



Verity Flameproof Fan

Moulded-tube Machine

The Société Maxei of Paris has recently introduced a special electrically-operated machine for the automatic production of tubes and terminals from synthetic moulding powders. The machine is capable of producing tubing up to 7 ft. 4 in. long and 7 in. in diameter.

Controlled-frequency Clocks

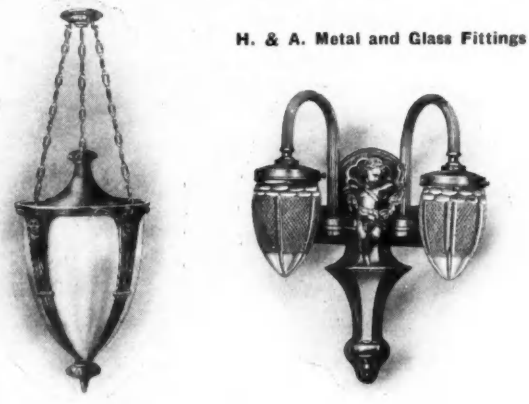
For use on 200- to 250-V, 50-cycle, controlled-frequency supply circuits, BRITISH SANGAMO CO., LTD., Cambridge Arterial Road, Enfield, have introduced a range of very attractive synchronous clocks. The Sangamo clock is fitted with a small specially designed synchronous motor which runs at the very low speed of about 158 r.p.m., thus ensuring long life for the clock. It is claimed to be quite silent in operation, and it is provided with a seconds hand or disk for visual indication. The clock is brought into operation by a starting lever.

Lift Floor-levelling Apparatus

A recent development by PICKERINGS, LTD., Globe Elevator Works, Stockton-on-Tees, is a self-floor-levelling equipment especially suitable for high-speed passenger lifts. The apparatus is entirely self-contained and embodies the usual direction and control switches for the various floors, together with the floor-levelling mechanism. The complete unit is fixed in the lift machine house and therefore eliminates any noise of switch operation in the well hole. As all the control wiring is between the controller and unit the risk of breakdowns in the well-hole wiring is eliminated. All adjustments and cleaning are made in the machine house, so that the maintenance engineer can examine the whole sequence of operations, both for normal stopping and floor-levelling. The equipment has been so designed as automatically to compensate for stretch of ropes, &c., and is practically silent in operation. Upon a recent lift installation of this type exhaustive tests were made, and the results were in all respects equal to those obtained with floor levelling units of the types involving operation by well-hole switches near the cage, or by switches on the cage operated by ramps in the well.

Attractive Lighting Fittings

Examples of the artistic effects which can be produced by metal and glass construction of electric lighting fittings are depicted in the accompanying illustrations of two appliances recently introduced. The illustration on the left is of a hanging globe with ornamental metal work, and that on the right



H. & A. Metal and Glass Fittings

is of a novel two-light wall fitting with ornamental metal work portraying a human figure. Both fittings have been designed and are manufactured throughout by HAILWOOD & ACKROYD, LTD., Morley, near Leeds.

Ignition-faults Detector

A simple device intended rapidly and efficiently to locate faults in either the coil or magneto ignition systems of motor vehicles has lately been put on the market by the MAGNETO SERVICES CO., High Street Corner, Halifax. The tester incorporates a sliding rod having an insulator knob, and when the rod is pulled out for the maximum distance it connects the magneto or coil to a high-resistance gap, thus indicating the voltage generated. To use the device the sparking-plug wire is removed and the terminal at the tester end fixed in its place. The wire removed from the sparking plug is connected to a terminal marked in red, the earth wire of the tester being clipped to another part of the engine. The plugs can then be tested simply by holding the end terminal of the tester in contact with the plug terminal, the fact that current is passing being indicated in a small window. After the sliding rod has been pulled out as far as possible a distinct spark will, so long as the circuit is up to standard, pass across the gap.

L. G. H. Neck-tie Iron

A Neck-tie Iron

An innovation in domestic electrical equipment is the "Nek-tie" iron introduced by L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, Kingsway, W.C.2. It is made in aluminium with a fibre handle, and is loaded at 50 W.

"Fulmen" Electroautometer

The Société Belge de l'Accumulateur Fulmen, 266, Chaussée de Haren, Vilvorde, Belgium, has recently introduced a neat and compact instrument, the "Fulmen Electroautometer," designed for use in the repair of ignition, lighting and engine-starting equipment of motor vehicles. It is a bench instrument comprising in an aluminium case measuring about 8 in. by 10½ in. by 11¼ in., a double-graduated voltammeter with a red 20-0-20 and black 40-0-40 scales, giving readings separately of from 0 to 20 A and 0 to 400 A, and 0 to 4 and 0 to 20 V. Flexible cables with terminal clips enable connections to battery and other terminals to be made quickly. Any of the following tests can be carried out; intensity of current developed by starting motors, battery voltage, dynamo output when charging battery, output of accumulators when in use for lighting lamps, voltage of separate cells of battery, insulation condition of wiring installation, &c.

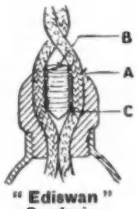
Mangle Driving Unit

The "Pioneer Joywheel" is a driving unit recently produced by WHITTAKER BROS. (ACCRINGTON), LTD., Pioneer Works, Accrington, for converting an ordinary mangle to electric driving. It consists of a ¼-h.p. B.T.-H. drip-proof motor mounted on a pedestal which stands beside the mangle. Provision is made for adjusting the castor cups in which the mangle feet stand and for fixing the unit in the exact working position. The only alteration which need be made to the mangle is the removal of the flywheel. The unit can be instantly detached from the mangle. Pressure of the foot on the pedal at the base of the unit raises the motor slightly and brings the driving pulley into contact with the rim of the flywheel, driving the rollers at the average turning speed. Immediately on removing the foot from the pedal the driving bush comes out of contact with the flywheel and the rollers stop turning. The motor is controlled by a handy damp- and shock-proof switch fixed on the stand. Three yards of 3-core c.t.s. cable is provided for connecting and earthing the motor. The makers have also marketed a complete electric mangle which combines the advantages of the electric drive with compactness and saving of space. The motor is incorporated in the side of the mangle, and the whole machine takes up no more space than an ordinary mangle.

"Pioneer Joywheel"

A Cord-grip

The "Ediswan" lampholder cordgrip recently introduced by the EDISON SWAN ELECTRIC CO., LTD., 123-5, Queen Victoria Street, E.C.4, is moulded from "Fabrolite" powder, and incorporates some distinctive features. The flexible is threaded through the cordgrip and connected to the porcelain in the usual way. The two leads are then opened out as illustrated at A, and the screw plug B is inserted and tightened up. It is claimed that the grip will support a weight of 56 lb. before the flexible will pull out, and that the grip does not injure the insulation. There is less risk of the leads breaking at the point of entry, as they are gripped at points C a little way inside the cordgrip.



"Ediswan" Cordgrip

Split-core Current Transformers

A range of "Shotter" split-core current transformers has been introduced by ELLIOTT BROS. (LONDON), LTD., Century Works, Lewisham, S.E.13, to enable the a.c. in a cable to be measured without interrupting the supply. Light and compact, they are wound for a secondary current of 5 mA at full load, thus permitting the use of very long leads, and with the special indicating instrument each forms a very compact testing set. Each transformer is made for various loadings, and adjustment is effected by altering the length of the air gap by a clearly marked screw barrel. Owing to the air gap errors due to dirt in the gap are avoided. For use on h.p. circuits and where the conductors are bare or lightly insulated a "scissor" type transformer with insulating handles and the indicating instrument incorporated in the unit is recommended. The clamp-type unit is made in two sizes, both for up to 500 V, for cables of 1 and 1¾ in. diameters, with loading ranges of from 50 to 200 A and from 250 to 1,000 A, respectively. The "scissor" model is made in three sizes, 1 in. for up to 500 V and from 50 to 200 A, 1¾ in. for up to 500 V and from 250 to 1,000 A, and 1¾ in. for up to 6,600 V and from 250 to 1,000 A.

"Shotter" Clamp Current Transformer

Chemists' Jubilee Celebrations

LEADING scientists from all over the world are to attend the jubilee celebrations of the Society of Chemical Industry, which will take place in London next week, commencing July 13th. The proceedings will be under the presidency of Sir Harry McGowan, president of the Society, and will comprise a wide programme of scientific discussions, social functions, and visits to industrial centres. During the celebrations honorary membership of the Society (a very rare distinction, only previously awarded on six occasions during the 50 years of the Society's existence) is to be conferred on representative leading members of the industry in each of the world's principal industrial countries, and a feature of the proceedings will be the delivery of addresses by these distinguished scientists on various days during the week. A very wide selection of works and factory visits will be available, including the General Electric Co., Ltd., and the National Physical and Chemical Research Laboratories at Teddington.

Exhibition

Throughout the week a comprehensive exhibition of British chemical plant and research and recording instruments, arranged by the British Chemical Plant Manufacturers' Association in co-operation with the Chemical Engineering Group of the Society of Chemical Industry, will be held at the Central Hall, Westminster, and practically every important firm of British chemical plant manufacturers will be exhibiting. A section will be devoted to the work of the Department of Scientific and Industrial Research and of the various research associations.

One of the exhibits is to be an ultra-violet testing cabinet. When rays from a mercury-arc lamp filtered through a Chance "Uviol" screen (wave length from 4046 to 3022 A) are allowed to fall on to various objects, their luminescence can be observed; such luminescence frequently indicates qualitative differences in substances used in the textile industry, such as different fibres, oils, adhesives, &c. Patterns show the effect of irradiating spots of hydrocarbon oils in the "Fugitometer." By this means rapid estimation of the tendency of such oils to form stains can be made and the effect of scouring and dyeing such patterns is also shown.

An electromagnetic microbalance to be shown has the advantages of robustness and extreme sensitivity. An aluminium beam supported at its centre by a strip of steel carries a mirror and damping vane, and deflections are measured by a lamp and scale method. One end of the beam carries a light scale pan, and the other a fine permanently magnetised steel wire which dips into the core of a solenoid, the current through which is adjustable. The force due to the weight on the pan is then balanced by the force due to the magnetic attraction between the solenoid and the wire. The sensitivity can be altered by varying the tension of the strip and can be made very large by balancing out the torsional and gravity controls, the centre of gravity of the beam being above the axis of rotation.

Electro-deposited Coatings

Work carried out in the Research Department, Woolwich, has included extensive research on the development of methods of electro-depositing nickel and other metals free from defects, such as pinholes, and possessing suitable mechanical properties, and a study of methods for securing good adhesion between the deposit and the basis metal. The specimens to be exhibited illustrate the range of mechanical properties obtainable in electro-deposited nickel and methods of measuring the adhesion of electro-deposited nickel on steel, illustrating the greatly improved adhesion obtainable by the use of special cleaning methods. Also methods of measuring stress in electro-deposited nickel; the application of a feroxyl paper test for the determination of porosity in coatings on iron or copper base alloys, including tin-plate; and the effect of contamination of a nickel bath by small amounts of chromic acid.

Industrial X-ray Analysis

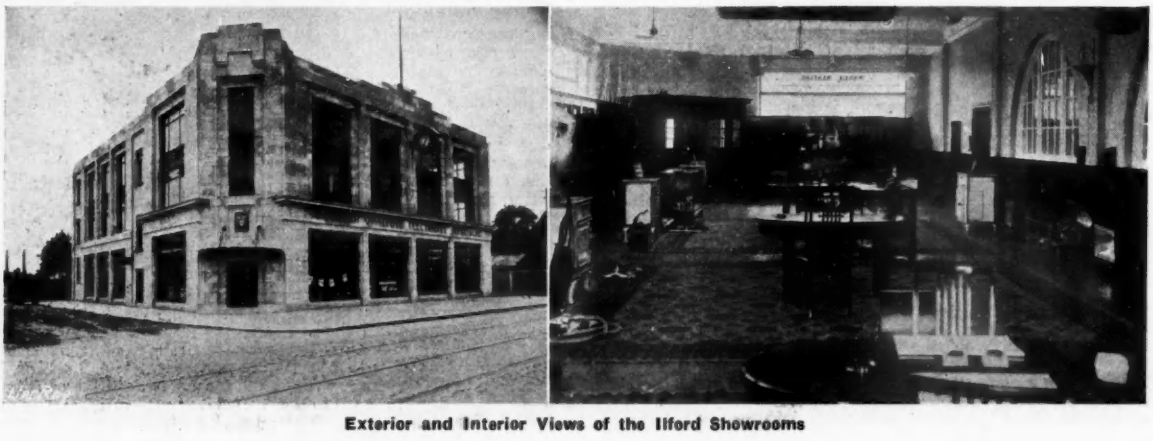
One of the National Physical Laboratory's exhibits is to be typical standard apparatus designed for the application of X-ray analysis to industrial problems. An X-ray tube with variable anti-cathode is to be shown, together with different forms of X-ray spectrometers. The photographs accompanying the apparatus will illustrate different phases of the applications of the method and show how physical and chemical changes in the solid make themselves evident by changes in the diffraction patterns. The method is particularly adapted for qualitative chemical analysis and can be used with success when the crystals are sub-microscopic in size as in cellulose, rubber, wool, silk, &c.

The Fuel Research Station will have a number of interesting exhibits as will also various metals research organisations.

New Ilford Showrooms

THE borough of Ilford has a large residential population and the demand for electricity for domestic purposes, therefore, is a considerable one and has played an important part in the development of the undertaking. For some years past the Council has had two showrooms, but the very large increase in the domestic load during the last few years has brought forward the necessity for securing additional accommodation for the clerical staff, and at the same time providing large central showrooms. New premises have therefore been erected on a site in the High Road, and these were formally inaugurated by the Mayor, Ald. H. G. Odell, who is also chairman of the Ilford Electricity Committee, on Saturday last. We reproduce below photographs of the showrooms, from which it will be seen that they are of imposing appearance and dimensions. On the ground floor, facing the High Road, is the general showroom which has a total length of 84 ft. and is 30 ft. wide, having four large display windows in front, and one in Clark's Road. This room is in mahogany, with oak floor blocks, and its spacious proportions permit of a well-arranged display of domestic appliances of all kinds. At the rear of the showrooms is a large office for the payment of accounts and for dealing with inquiries, while from the showroom a corridor leads to the main staircase and lift and to the demonstration room. This room is also large, being 33 ft. in length, and it has been so arranged that with the aid of sliding partitions it can be converted into three separate compartments. The first floor provides accommodation for the engineer and his staff, while the second floor contains a large demonstration kitchen, in which a series of electric cooking demonstrations have already been arranged. The remainder of this floor has been reserved for further office extensions. The roof is a flat one and the building has been designed to allow of another floor being added at some future date. The lavatories are all provided with electric water heaters, and the heating of the building will be provided by tubular, electro-vapour and other radiators. The electrical installation, fittings, apparatus, &c., were installed by the Electricity Department under the supervision of Mr. A. H. Shaw, the borough electrical engineer.

Councillor Major A. Young, vice-chairman of the Electricity Committee, who presided over the proceedings last Saturday, in introducing the Mayor, stated that their output last year totalled 23½ million kWh, and the average price was 1.796d. per kWh. In reviewing the development of the undertaking he paid a tribute to Mr. Shaw, Mr. G. F. Gregory, the deputy borough electrical engineer, and Mr. H. King, the commercial manager. Alderman Odell, in declaring the showrooms open, remarked that Ilford stood sixth in the list of supply authorities in the London area for the lowest tariff. The showrooms would meet their needs for some time to come, and were a credit to the borough engineer, Mr. L. E. J. Reynolds. Mr. Shaw presented Alderman Odell with a "Magicoal" fire, on behalf of a number of electrical engineers in various parts of the country, as a token of their esteem.



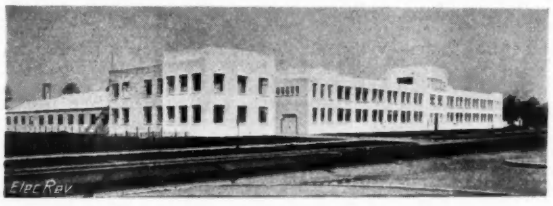
Exterior and Interior Views of the Ilford Showrooms

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

Venner's New Works

To provide accommodation for its expanding business, VENNER TIME SWITCHES, LTD., has recently opened new works at Kingston By-pass Road, New Malden. The building (shown below) has a floor space of 60,000 sq. ft., and has been erected upon the most modern lines, the maximum of daylight having been provided in the factory and offices. The steel framed roof is carried upon steel stanchions, and the whole of the main manufacturing workshop, of one acre in extent, has no dividing walls. The administrative portions of the buildings are also steel framed, and upwards of six miles of steel of various sections have been used in the structure. Only materials produced in the British Empire have been used throughout the building. The sign over the main entrance has been designed for effect under floodlighting as well as in daylight, and is formed of broken bottle glass embedded in the white cement. The heating system is entirely automatic, with oil-fired boilers and



The New Venner Works, New Malden

unit hot air ejectors under thermostatic control. Adequate canteen accommodation has been provided for the staff, with all-electric cooking apparatus, and facilities for clubs, dances and lectures.

D.O.T. Market Memoranda

Confidential memoranda regarding methods of trading and the appointment of agents in the Philippine Islands and Persia prepared by consular officials have been received in the Department of Overseas Trade and issued to firms whose names are entered on its Special Register. British firms desirous of obtaining copies of these should apply to the Department, 35, Old Queen Street, S.W.1. Reference Nos. C.X. 3571 (Philippines) and C.X. 3586 (Persia) should be quoted.

Bingley Showroom Scheme Deferred

By a majority of 10 votes to 8, the Bingley Urban District Council, at a special extraordinary meeting held recently, reversed its previous decision in regard to the proposed expenditure of £3,700 on the purchase of shop property in Main Street and its conversion to electricity showrooms. The Council will now have to find means of disposing of the shop property, to the purchase of which it is already committed. The showroom scheme had been approved by the Electricity Commissioners, and is now deferred for twelve months.

The British Industries Fair

The British Industries Fair buildings at Castle Bromwich, Birmingham, are to be extended at a cost of £20,000 in order to accommodate the new sections which have been announced for next year and to meet increasing demands for space from regular exhibitors. Old buildings covering 1½ acres are being pulled down and three new roofs, covering an acre each, will bring the total inside letting space up to 250,000 sq. ft. For the next Fair there will be 13 acres of exhibition buildings in all at Castle Bromwich, with 30 acres of ground available for further extensions.

All the buildings at Olympia, London, with a total exhibiting area of 300,000 sq. ft., are to be used for the Fair and there is expected to be some difficulty in meeting the applications for space, which have now been invited by the Department of Overseas Trade. In the new textile section at the White City, London, which is to cover all branches of the industry, the four halls originally allotted were quickly found to be inadequate and four additional halls are now being filled up rapidly.

The Marking of Imported Electricity Meters, &c.

The Board of Trade announces that among new Orders-in-Council made on June 29th under Section 2 of the Merchandise Marks Act, 1926, was the Merchandise Marks (Imported Goods) No. 10 Order, 1931, which requires electricity meters to bear an indication of origin on importation, or on sale or exposure for sale in the United Kingdom, and the following parts of such meters, namely, the case, the rotor, the shunt system, and the series system, to bear an indication of origin on sale or exposure for sale in the United Kingdom. This Order will come into force on September 29th next.

Merchandise Marks (Imported Goods) No. 9 Order, 1931, requires imported air or gas compressors or exhausters and pneumatic tools or appliances to bear an indication of origin on sale or exposure for sale in the United Kingdom. This Order also comes into force on September 29th.

The Making of a Salesman

In the June issue of *Lightning* (the house journal of Messrs. Ferranti, Ltd.), Mr. R. H. Schofield, A.M.I.E.E., the company's sales manager, writes on "What Makes a Good Salesman?" The author maintains in this that selling is not an art, any more than engineering is, and a salesman must learn his job. Mr. Schofield thus puts thorough knowledge of the product forward as the first essential, and says that the salesman must keep up to date, and acquire culture or general knowledge. Certain personal qualifications then enter into the matter, among them being courage, self-confidence, intuition, trustworthiness, stability, energy and good health.

A Machinery Credit Plan

In order to assist the engineering industry to re-equip itself—a course which is repeatedly stated to be necessary—Messrs. George Cohen & Sons, Ltd., 600, Commercial Road, E.14, have instituted a credit scheme by which purchasers of machine tools and equipment may spread their payment for this over a period of two years. They state that they are financing the scheme entirely from their own resources which ensures that all transactions are treated confidentially.

Telephone Development

To assist him in his endeavour to speed up the development of the telephone service, the Postmaster-General has appointed a committee to advise him with regard to advertising the service. He will act as chairman of the committee, the members of which are Sir William Crawford, Sir Francis Goodenough, Mrs. E. Wood, Mr. S. G. Tallents, Mr. L. Simon (Director of Telegraphs and Telephones) and Mr. A. E. Powell-Jones (director, Telephone Development Association).

Scottish Ideal Home Exhibition

As a development of the Housing and Health Exhibition, hitherto held each year under the auspices of the Glasgow Corporation, an exhibition is to be held this year from September 30th to October 24th at the Kelvin Hall, Glasgow, under the title of the Scottish Ideal Home Exhibition. While arrangements have been made for the support of the Corporation, the organisation and administration of this new exhibition will be entirely in the hands of the *Daily Mail*.

Price Reductions

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., announces reductions in the prices of the joint boxes for use with its "Nomet" wiring system.

Seaside Floodlighting Schemes

The value of good lighting as an attraction to visitors during the summer months is being realised by the municipal authorities of a large number of our seaside towns, floodlighting in particular, being utilised to enhance the value of both the artificial amenities and entertainment facilities of these places. Two good examples of the use of floodlighting for this purpose are to be found in the illumination of the Palace Pier, Brighton, and of the St. Lawrence Cliff bandstand, Ramsgate. The former, which has recently been completed, employs forty-four weatherproof "Mirolux" trough reflectors specially adapted for the purpose, while the latter installation (shown below) consists of eighteen large "Ediswan" floodlight projectors, located on the roof of the pavilion, which flood the

The St. Lawrence Cliff Bandstand at Night

arena; and inverted rectangular "Mazdalux" projectors at the base of the stand, which floodlight the elevation of this structure. Both the above installations were designed and supervised by the illuminating engineering department of the Edison Swan Electric Co., Ltd., for the local authorities concerned.

A Russian Electrical Manufacturing Town

According to the Russian Press an "electrical town" is being established in the vicinity of Moscow which will consist of eleven works, with an annual production of the value of 920 million roubles. It is to be brought into operation in 1934, and, it is said, will occupy the first place in the world as a producer of low-pressure equipment. The works will turn out, among other manufactures, signalling apparatus for the railways, radio equipment and automatic telephone apparatus. It is calculated that some 75,000 persons will be employed at the completed works.

International Installation Materials Commission

Addressing the fifth congress of the Dutch Electrotechnical Association, which was held at the Hague last week, Prof. J. C. van Staveren, of Arnhem, referred to the question of the examination of installation materials. He recalled that a visit was paid to the German Association of Electricity Works, Berlin, some years ago, when the discussion which ensued on the unsatisfactory condition of many installation materials led to the formation of the Internationale Installations Fragen Kommission (the "I.F.K."), of which twelve countries are now members. As a result of the labours of this commission there are now in operation regulations for lampholders, hand lamps, radio sets, installation materials, incandescent lamps, rubber-insulated conductors, &c. The Commission has no compulsory powers, and its scope is consequently limited to the recommendation of suitable standards.

Austrian Lamp Production

The Osram Lamp Company, of Vienna, is reported to have absorbed the undertaking of the Vertex Elektro-works, of Atzgersdorf, and to have assumed the title of the "Austrian Glow Lamp Works Company." As from the beginning of this month the production of "Osram" lamps in Austria was commenced at the Atzgersdorf works, the Osram Company having previously only been conducted as a sales organisation.

Franco-German Export Agreements

In the annual report of the French Thomson-Houston Co. it is stated that the leading French producers of high-pressure machinery have entered into agreements with an important German group for the regulation of the export trade so as to avoid competition. The German group is said to be the Berlin A.E.G.

A Switchgear Sales Conference

The MIDLAND ELECTRIC MANUFACTURING CO., LTD., has sent us a cartoon souvenir of a sales conference which was recently held at its Birmingham works. In this a number of the leading agents and works officials are very cleverly caricatured.

German Radio Exports

The exports of radio apparatus from Germany have risen from 2,980.3 tons of the value of 35.9 million marks in 1926 to 7,476.6 tons (78.2 million marks) in 1930. During the first four months of the current year the exports amounted to 2,695.2 tons (27.10 million marks), this being a large increase over the corresponding period of 1930, when the exports were 2,055.6 tons (23.32 million marks). Great Britain is the best customer of the German works, this country's imports having risen from 1,135.3 tons in 1926 to 2,040.4 tons in 1930. In the first four months of 1931 the quantity sent to Great Britain was 833.7 tons, as compared with only 415.1 tons in the corresponding period of 1930.

German imports of radio apparatus also advanced—from 170.9 tons (2.75 million marks) in 1926 to 540.3 tons (10.81 million marks) in 1930. During the first four months of 1930 the imports reached 170.7 tons (3.16 million marks), while in the corresponding period of this year the quantity was 221.8 tons (4.60 million marks). Great Britain is one of the principal suppliers.

Trade with the Dutch East Indies

A confidential memorandum on methods of trading and terms of payment in the Netherlands East Indies prepared by the British Commercial Agent at Batavia, has been received in the Department of Overseas Trade and issued to firms whose names are entered upon its Special Register. British firms desirous of obtaining a copy of the memorandum should apply to the Department, 35, Old Queen Street, S.W.1, quoting reference number C.X. 3581.

Bradford Wool Fair

The Imperial Wool Industries Fair, which is being held in the Olympia Exhibition Hall at Bradford (July 3rd to 18th), is of some interest to engineers, especially the working machinery section, in which every machine displayed is electrically driven, some by means of belt drives, some by "Texrope" drives, others by chains, and yet others by worm gear. A variety of textile machines is on view, such as a waste-pulling and carding machine, interceptor gill-box, wool-combing machine, ring spinning and ring twisting, automatic loom, cloth testing, and humidifying machinery. The ring spinning frame is a high-speed machine made to run at a spindle speed of 7,000 r.p.m. for wool spinning and up to 11,000 r.p.m. for cotton spinning. The automatic loom is a great advance on the old-fashioned pattern for certain classes of work, as the makers claim that one weaver can look after thirty to fifty of these machines instead of two, as is often the case at present. The humidifying machine can be used successfully in the cable-making industry in connection with the braiding of wires and cables, apart from its many uses in the textile industry. Messrs. Smith & Croft were the official contractors for the distribution mains, &c., throughout the building, and Mr. Harry Moss, A.M.I.E.E., is acting as the consulting engineer to the fair.

Registered Electrical Contractors

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Brocklesby, F., Brooks Bar, Manchester.
Hardacre & Maltpress, Bootle, Liverpool.
Corts, Ltd., Leicester.
Bate Electrical Co., Ltd., London, E.C.4.
Mersey Electrics, Ltd., Bootle, Liverpool.
Hull, D., Blackburn.
Beavon & Sons, Ltd., Gloucester.
Foggo, J., & Son, Edinburgh.

New Showrooms at Eccles

The new electricity offices and showrooms of the Eccles Electricity Department at the corner of Church Street and King Street, Eccles, were opened on June 30th. The ceremony was performed by Alderman W. Pearson, J.P., chairman of the Electricity Committee. The new building is designed on simple and dignified lines and has imposing display windows looking out on to both streets. The entrance to the showrooms is at the corner, while the main office entrance is in King Street. The front portion of the building on both the ground floor and the basement is used as showrooms. The remainder of the ground floor provides accommodation for the whole of the clerical and administrative staff. On the first floor are the offices for the technical staff the borough electrical engineer's office and committee room, the drawing office and the plan and records store. Provision is also provided in the basement for a transformer station.

Batteries at the C.E.A. Exhibition

Among the electrical exhibitors at the display held in connection with the recent Cinematograph Exhibitors' Association conference at Brighton were EDISON STORAGE BATTERY DISTRIBUTORS, LTD., who showed examples of Edison steel-alkaline storage batteries for stand-by use in cinemas.

Radio Manufacturing in Australia

The *Sydney Morning Herald* reports that Mr. W. F. Winter, representative of the Dutch firm of Heberholds, Ltd., recently arrived in Sydney to investigate the prospects for the manufacture of dry batteries in Australia. If his report is favourable the company may erect a factory in Melbourne to give employment to 200 people. Mr. Winter is also attempting to introduce into Australia the "radio exchange" system by which broadcast programmes are relayed to subscribers.

British v. Foreign Plant in South Africa

The Pretoria Town Council recently discussed a contract for a 12,500-kW turbo-alternator set and condenser for the municipal power station. The Trading Committee recommended the tender of Messrs. C. A. Parsons & Co., Ltd., at £35,200. Messrs. Siemens (South Africa), Ltd., had put in a lower tender at £29,860, and criticisms were made of the recommendation to accept the higher tender. It was pointed out, however, that with the Parsons plant the municipality would save between £30,000 and £40,000 in twenty years, against £6,000 if the Siemens tender was accepted. The municipal engineer of Pretoria, Mr. Horrell, and the Cape Town municipal engineer, Mr. Swingler, both recommended the Parsons tender, in which an adjustment had been made which would reduce the amount by £3,000 in the cost of erection. The Council finally decided to accept the recommendation.

For Sale

Electric motors, switchboards, &c., at present at Windsor Brewery are offered for sale by Messrs. Lucas & Pyke, 39, Victoria Street, S.W.1.

(See our advertisement pages to-day.)

Australian Tariff Board Recommendations

Following an investigation into an application for an increase in the duties on dry batteries and dry cells, the Australian Tariff Board has recommended that no alteration be made in the 1921-8 tariff. Reporting on applications for increases in the duties on telephone and telegraph apparatus, the Board recommends that no alterations be made in the rates now in force under the tariff decisions of June 19th, 1930.

The Bath and West Show

In a recent issue (May 29th, p. 924) we illustrated some of the electrical plant exhibited at the Bath and West Show. One of the pictures showed a "Ferranti" boiler, and Messrs. Rhodes, Bryden & Youatt, Ltd., Stockport, inform us that with this were two demonstration water tanks. From the lower of these one of the company's "Mopump Minor" pumping sets raised water to the overhead tank. When the water level in the lower tank fell to a predetermined point, automatic switchgear (which was shown in the illustration) stopped the pump. When the lower tank filled, the operations were repeated. A push-button switch was provided to enable interested visitors to start up the equipment.

Australian Duty on Radio Valves

A number of deferred duties which were to have been imposed by the Commonwealth Government on July 1st have been further postponed. Among the articles affected are valves for wireless telegraphy and telephony, the duties on which have been postponed until January 1st, 1932.

An Electrical Exhibition at Northenden

An electrical exhibition was held recently by the Manchester Corporation Electricity Department in the Parish Room at Northenden. It was arranged primarily for the benefit of the residents of Northenden, Northen Etchells, and Baguley, which parishes were recently added to the city of Manchester. Demonstrations of electric cooking, washing, and cleaning were

A Corner of the Northenden Exhibition

held daily and attracted much attention. The accompanying illustration shows a corner of the exhibition in which were displayed a number of electric cookers and water heaters.

The F.B.I. Argentine Committee

The first meeting of the newly-constituted Argentine Committee of the Federation of British Industries, which has been formed to follow up the results of the British Empire Exhibition at Buenos Aires, was held recently. After passing a resolution of thanks to the Prince of Wales, the Committee decided upon the following future programme: The appointment of a small executive committee to study the various problems arising and to initiate suggestions for the development of British trade with Argentina for consideration by the main committee; to work in the closest possible touch with the Department of Overseas Trade and the British Chamber of Commerce in Buenos Aires, in formulating plans for trade development; to ensure the maximum amount of co-operation between British interests in tackling the Argentine market, both from the point of view of the representation of general trade interests, the creation of joint selling organisations, and the general question of publicity, and trade propaganda; and to take steps to form an Argentine Group of the Federation, composed of those associations and firms which are more particularly interested in the market, in order that the committee may be in a position to have really powerful industrial support for any suggestions for action.

The committee is a very representative one, and includes Mr. V. Watlington, of the English Electric Co., Ltd., who is the chairman, Mr. Ll. B. Atkinson (Cable Makers' Association), Mr. I. V. Robinson (B.E.A.M.A.), and Mr. L. E. Mather (Mather & Platt, Ltd.).

Japanese Import Concessions

As a measure of encouragement to the iron and steel industry, the Japanese Government, in 1926, announced that certain equipment would be allowed to be imported by the industry free of duty. The *Board of Trade Journal* now announces that these regulations have been revised and, as a consequence, certain machinery and equipment are no longer granted this remission. This applies, *inter alia*, to gas-electric generators, exhaust steam turbines and furnace electrodes. Magnetic separators, cranes and continuous conveying machinery are, however, still to be admitted free of duty.

Refrigerators in Australia

A recent report to the Department of Overseas Trade by the Senior Trade Commissioner in Australia deals with the market for small automatic refrigerators. In this it is stated that the expansion of the trade has been checked by the general depression and by the imposition of a prohibitive import duty. The bulk of the imported refrigerators have been supplied by the United States, but now two reliable Australian makes are on the market and these, assisted by the before-mentioned duty, are making headway. There is considered to be little scope for British refrigerator manufacturers at present, but it is suggested that if an attempt is to be made in the market, suitable electrical houses in each State should be appointed as distributors. Another suggestion is that all parts which can be made in Australia should be manufactured locally, the motors and casings being imported. An efficient after-sales service is essential.

The "prohibitive duties" mentioned in the report appear to be causing trouble to local assemblers of refrigerators. Application has been made to the Tariff Board for a reduction of the impost, it being considered that duties of 45 per cent. British preferential and 60 per cent. general are sufficient. At present these duties are subject to a surcharge of 50 per cent. and a primage duty of 4 per cent.

Recent Contracts

An installation is being carried out for the Cumberland Granite Co., Ltd., Cockermouth, by MESSRS. PETTERS, LTD., comprising an atomic Diesel engine of 325 b.h.p., directly coupled to an alternator, running at a speed of 273 r.p.m. The engine has five cylinders and is of the cold-starting two-stroke type.

STANDARD TELEPHONES & CABLES, LTD., has received an order for supervisory remote control equipment for the Redditch sub-station of the Shropshire, Worcestershire and Staffordshire Electric Power Co. Another order received by the company is for two D.1 single-channel carrier-telephone

Trade Announcements

The North Wales office of the NORTH WALES POWER CO., LTD., has been removed to 6, Egerton Street, Wrexham. Telephone: Wrexham 678. Telegrams: "Aqualek, Wrexham."

Messrs. J. HEDGES, STAPP & SON, electrical and heating engineers, of Huntingdon, have removed from 60, Ermine Street to more central premises at 58, High Street.

On and after August 1st the address of the Hull branch of the GENERAL ELECTRIC CO., LTD., will be 164, 166 and 168, George Street, Hull. The telephone numbers have been changed to Hull 34625 and 34626.

The offices of STANDARD TELEPHONES AND CABLES, LTD., have been transferred to Connaught House, Aldwych, W.C.2. The telephone number (Holborn 8765) is unaltered.

Book Notices

"Mica for Electrical Purposes." Pp. 14 and 7 figs. London: Micanite and Insulators Co., Ltd.—This publication contains in a condensed form much general information on the origin, grading, and characteristics of the numerous existing varieties of mica, as well as on the selection and varied applications of this mineral, which plays so important a part in electrical insulation.

"Fuel Economy Review," Vol. X, 1931. Issued by the Federation of British Industries. Price 2s. 6d.—This edition contains some very interesting articles by expert authorities who discuss the various problems of power in industry.

Lighting a Modern Garage

The lighting arrangements of the recently-opened Bristol Sales and Service Station are of special interest inasmuch as they demonstrate the modern tendency to employ lighting in buildings of this nature for attractive as well utilitarian purposes. The most outstanding feature of the exterior is the square clock tower which is floodlighted by means of Ediswan "Star" type "X-ray" floodlight projectors. As will be seen from the accompanying illustration the tower makes an impressive picture by night and forms something of a landmark for the motorist. The showroom too presents an inviting aspect, the lighting effects being obtained by means of "Swankirk" enclosing fittings supplemented by a carefully planned series of "Jack"-type "X-ray" reflectors. In the lighting of the main garage areas and machine shop a number of "Mazdalux" dispersive reflectors are employed. An unusual type of fitting is employed in the lighting of the cellulose-spraying booths. The fittings are completely gas- and water-

The Floodlighted Exterior of the Garage

tight, thus ensuring that the lampholders and wiring remain immune from the corrosive effects of the paint spray, and minimising danger from fire when dealing with this highly inflammable material. The entire installation utilises approximately 150 points and was designed and supervised throughout by the illuminating engineering department of the Edison Swan Electric Co., Ltd., in collaboration with the associated architects, Messrs. Chas. White, and Todd & Thompson, of Bristol.

New Catalogues and Lists

W. CANNING & Co., LTD., 133-7, Great Hampton Street, Birmingham.—A leaflet, describing two new portable units for the filtration of plating solutions.

BERRY'S ELECTRIC, LTD., 85-86, Newman Street, Oxford Street, London, W.1.—A folder, giving particulars of the company's "foolproof" switchgear.

The SUN ELECTRICAL Co., LTD., 118 and 120, Charing Cross Road, London, W.C.2.—A showcard, depicting the "Capehart" record changer.

KLEANAIR PATENT FAN Co., LTD., Ware, Herts.—A catalogue, illustrating and describing the "Kleanair" fan and air purifier.

T. F. SNOW, 247, Shakespeare Road, London, S.E.24.—A display card of "Snow's" lead-headed wall nails.

The MARCONIPHONE Co., LTD., 210-212, Tottenham Court Road, London, W.1.—Three attractive posters and a window bill advertising the company's radio equipment.

The IGRANIC ELECTRIC Co., LTD., 149, Queen Victoria Street, London, E.C.4.—Publications Nos. 6734 and 6735, dealing respectively with "Igranic" super-heterodyne coils and the "Phonovox" gramophone pick-up.

MARELLI & Co., LTD., 19 and 20, Garlick Hill, Queen Victoria Street, London, E.C.4.—Leaflet AS/2540 relating to the company's new "A.S."-type exhaust and ventilating fans.

HERBERT MORRIS, LTD., Loughborough.—A 438-page book (No. 187) relating to "Morris" conveyors. The publication, which is very profusely illustrated, deals primarily with conveyors employed by the general engineering and allied trades. Chapters are devoted to foundries, motor-car works, chemical and associated trades, glass-making plant, the timber trade and the paper industry and also the textile and allied businesses.

GILBERT GILKES & GORDON, LTD., Kendal.—List No. 1,251, dealing with the G.G.G self-priming centrifugal pumps, suitable for house water supply, &c.

"MONITOR" PATENT SAFETY DEVICES, LTD., Monitor Works, King's Road, Wallsend-on-Tyne.—A revised catalogue of "Monitor" valves, flow indicators, alarm boards, &c.

The BRITISH ELECTRIC TRANSFORMER Co., LTD., Wellington House, Strand, London, W.C.2.—An illustrated folder referring to the "Tricity" electric built-in oven equipment.

Calendar-blotters for July have been received from the following:—The JACKSON ELECTRIC STOVE Co., LTD., 143, Sloane Street, London, S.W.1; TAYLOR, TUNNICLIFF (REFRACTORIES), LTD., Albion Works, Longton, Staffs.; POPE'S ELECTRIC LAMP Co., LTD., 5, Arthur Street, New Oxford Street, London, W.C.2; WARREN BROS. (MIDDLESBROUGH), LTD.; and MAVOR AND COULSON, LTD., 47, Broad Street, Glasgow, S.E.

The DRAYTON REGULATOR AND INSTRUMENT Co., LTD., West Drayton, Middlesex.—A leaflet, relating to the "Drayton" variostat for the proportional control of water-heating systems.

GIRLINGS, LTD., Electricity Works, Maldon, Essex.—A leaflet (No. 150), illustrating and describing the company's "Mosaic" electric fires.

The ELECTRICAL EQUIPMENT AND CARBON Co., LTD., 107/111, New Oxford Street, London, W.C.2.—Lists S.C.16 and 17, giving details of "Siemens-Plania" kinematograph and therapeutic carbons.

RICHARD JOHNSON, CLAPHAM & MORRIS, LTD., Jacem House, Trafford Park, Manchester.—List No. E6/31, dealing with "Jacem" lighting glassware, wood panel fittings, lampshades, galleries, ceiling plates, &c.

The UNIVERSAL ELECTRIC LAMP Co., 89, Great Eastern Street, London, E.C.2.—A folder, giving prices and particulars of "Yunos" electric lamps.

PETTERS, LTD., Westland Works, Yeovil.—An illustrated catalogue (No. 2079) of "Petter" surface-ignition cold-starting oil engines.

FERRANTI, LTD., Hollinwood, Lancs.—Leaflets illustrating and describing the "Ferranti" type "F.L." meter.

Social Event

The annual outing of the staff of Robert Hornby & Co., Ltd., was held on June 17th, when between 70 and 80 members and guests spent an enjoyable day at Cliftonville.

Bankruptcy Proceedings

HENRY EVANS, electrical factor, 60, Berners Street, W., and Harrow.—The first meeting of creditors was held last week at the London Bankruptcy Buildings when a statement of affairs was submitted showing liabilities of £962 (ranking £258) and no available assets. The debtor stated in his preliminary examination that he had carried on business at 7, Charlotte Street, Tottenham-Court Road, W.C., under the style of "Evans' Electrical Fittings Company." He had also acted as sales manager to Frederick Thomas & Co., Ltd., who claimed to be creditors for £240 in respect of alleged overdrawn commission. His trading was not successful, and with a view to starting a new line he registered "H. Evans' Electrical Fittings Co., Ltd.," with offices at 60, Berners Street, and the capital of the company was £1,000; he was appointed director at a salary of £4 a week and the company discharged the existing liabilities of the old business. He resigned his directorship owing to these bankruptcy proceedings having been instituted by Frederick Thomas & Co., Ltd. The debtor attributed his failure and insolvency to his liability under the judgment obtained by the petitioning creditors and to law costs. The case was left in the hands of the Official Receiver.

G. A. RICHARDSON, wireless goods dealer, lately trading as G. Richardson, 41, Grand Parade, Woodhouse Road, North Finchley.—The statutory first meeting of creditors was held on July 1st at London Bankruptcy Buildings, a receiving order having been made on June 18th. A private meeting of his creditors was held in April last, and he executed a deed of assignment. Three creditors did not consent to the deed, however, and the present proceedings ensued. He estimated his liabilities at £850 and scheduled assets to the value of £220. He attributed his failure to lack of capital, loss in connection with a branch business, and loss of credit facilities. The estate was left in the hands of the Official Receiver.

J. S. BLACKBURN, electrician, Borough Street, Castle Donington.—Receiving order made, June 25th, on debtor's own petition. First meeting, July 10th, at the Official Receiver's offices, 22, Regent Street, Park Row, Nottingham. Public examination, July 21st, at the Court House, 20, St. Peter's Churchyard, Derby.

R. RAMSDEN, wireless and electrical contractor, 29, Gibbet Street, Halifax.—Receiving order made June 25th, on debtor's own petition.

C. H. LAWSON, electrical contractor, 1,079, Chester Road, Stretford, Manchester.—Receiving order made June 25th, on debtor's own petition.

H. C. ROBINSON, electrical engineer, 41, St. Botolph Street, Colchester.—First meeting held July 7th at 9, Arcade Street, Ipswich. Public examination, July 30th, at the Law Courts, Town Hall, Colchester.

B. SMITH (H. Worton), electrical engineer, The Crescent, Spalding.—Trustee, Mr. C. E. Turton, 4 and 6, West Street, Boston, released May 21st.

W. F. FLINT, electrical engineer, 53, Jameson Street, Hull.—Last day for receiving proofs for dividend, July 15th. Trustee, Mr. J. E. D. Stickney, 37, Scale Lane, Hull, Official Receiver.

F. J. WELBERRY, electrician, The Beeches, Seathorn Estate, Skegness.—First and final dividend of 17s. 9d. in the £, payable July 3rd at the Official Receiver's office, 10, Bank Street, Lincoln.

A. J. HODGES, electrical engineer, 4, Binswood Street, Leamington Spa.—First meeting, July 15th, at the Official Receiver's office, 9-11, High Street, Coventry. Public examination, August 19th, at the Shire Hall, Warwick.

Company Liquidations

BURFORDS, LTD.—Meeting, July 31st at 40, Great James Street, Bedford Row, W.C., to receive an account of the winding up by the liquidator, Mr. T. H. Gentry.

CHARLES ROBERT DIBBEN, LTD.—Winding up voluntarily. Liquidator: Mr. H. N. Phillips, 115-119, Moorgate, E.C.

CARRARA-VERSILIA ELECTRIC RAILWAY & POWER Co., LTD.—Winding up voluntarily. Liquidator: Mr. E. F. Norman, 19-21, Queen Victoria Street, E.C.

LEEDS ELECTRICAL CONSTRUCTION Co., LTD.—Winding up voluntarily. Liquidator: Mr. H. S. Rhodes, 1, Charmouth Street, Leeds.

DYNIC INTERNATIONAL RADIO, LTD.—Winding up voluntarily. Liquidator: Mr. H. A. Kellie, 64, Victoria Street, S.W.

HADDER'S INSULATIONS, LTD.—Meetings at 5, John Street, Bedford Row, W.C., on August 5th to receive an account of the winding up by the liquidator, Mr. W. E. Thorpe.

Private Arrangements

AEONIC RADIO, LTD., late of Horley, Surrey.—Notices have been issued, convening a meeting of the creditors of the above for the purpose of considering a scheme for the settlement of the company's liabilities. In a circular which has been issued, it is stated that Aeonic Radio, Ltd., is in voluntary liquidation under a scheme of reconstruction under which a company was formed entitled Electrical and Radio Products, Ltd., which became entitled to the whole of the property and assets of the old company for a consideration. Mr. J. L. Gottlieb, the managing director of the old company, is now the managing director of the new company, and holds a legal mortgage upon the old company's freehold property and premises at Horley, Surrey, and the fixed plant and machinery under which approximately £10,000 is due. Certain of the unsecured creditors of the old company, whose claims amounted to £2,829, agreed to accept the new company as their debtors. The remaining indebtedness of the old company, apart from a claim by Marconi's Wireless Telegraph Co., Ltd., is about £32,319, of which £6,382 is admitted, and £25,937 is not admitted. The unadmitted claims include £19,000, an approximate amount claimed by the liquidator of a subsidiary company of the old concern in Germany. It is proposed that within three days of an order being made sanctioning the scheme, Mr. J. L. Gottlieb shall pay £270 to the liquidator as a deposit and within 30 days a further £2,430, which is the estimated amount necessary to make up the equivalent of 4s. in the £ on the claims of the unsecured creditors of the old company. It is also proposed that on or before July 31st, next, there shall be paid to Marconi's Wireless Telegraph Co., Ltd., a sum of £1,000 in full settlement of the action now pending against the old company. The Products Company will be released from any liability under the reconstruction agreement.

E. C. PORTER, electrical engineer, 48, Cranbrook Road, Ilford.—A meeting of creditors was held on July 6th at Anderton's Hotel, Fleet Street, London, E.C. Mr. P. Houston, of

the British Traders' Association, was elected to the chair. The statement of affairs showed ranking liabilities of £2,939, of which £2,187 was due to the trade, and £752 to cash creditors. After allowing £103 for preferential claims, the net assets were £840, or a deficiency of £2,099. An offer was submitted of a composition of 5s. in the £, payable as to 2s. 6d. in two months and the balance in four months. A long discussion took place, but the meeting eventually broke up without any definite resolution being passed. The following are the principal creditors :—

	£		£
Sloane Electrical Co., Ltd.	1,050	Philips Lamps, Ltd. ...	90
General Electric Co., Ltd.	353	Edison Swan Electric Co., Ltd.	74
National Electric Supplies Co., Ltd. ...	202	Borough of Ilford Electricity Department ...	56
Holophane, Ltd. ...	103	Falk, Stadelmann & Co., Ltd.	44

Dissolution of Partnership

HALE ELECTRICAL WIRELESS SUPPLIES, wireless dealers, 14, Mile End Road, E.—The partnership between Mr. S. Ettinger, Mr. M. Kalisky, and Mr. H. Aarons has been dissolved, so far as concerns Mr. Ettinger who has retired from the firm.

Winding-up Petitions

ELECTRICAL & RADIO PRODUCTS, LTD.—In the Chancery Division on Monday last, Mr. Justice Maugham had before him a petition for winding-up of this company by Henrion Carbons, Ltd. Mr. Wynn Parry stated that a meeting had been convened for the following Thursday (yesterday) to consider a scheme and it was hoped that the result would be satisfactory. He asked that the petition should stand over to come on with the scheme on July 20th. His Lordship ordered accordingly.

AEONIC RADIO, LTD.—On the same day Mr. Justice Maugham heard a petition for the winding-up of Aeonic Radio, Ltd. It was stated that a scheme of arrangement was being prepared and, by consent, the petition stood over again to come on with the scheme on July 27th.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

	CHEMICALS, &c.	Price July 7th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac T.N.... ... ... per cwt.	£4 5s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£85 to £90	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet and Foil ... ,,	1/1 to 2/9	...
b	Babbits Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£116	£12 Inc.
	Grade II ... ... ,,	£83	£8 Inc.
	Grade III... ... ... ,,	£48	£3 Inc.
c	Brass (rolled metal 2" to 12" basis) per lb.	7½d.	½d. Inc.
c	,, Tubes (solid drawn) ... ,,	9½d. to 9¼d.	½d. Inc.
c	,, Wire, basis ... ... ,,	7¼d.	½d. Inc.
c	Copper Tubes (solid drawn) ... ,,	10½d.	½d. Inc.
g	,, Bars (best selected) ... per ton.	£70	£3 Inc.
g	,, Sheet ... ... ,,	£70	
g	,, Rod ... ... ,,	£70	
d	,, (Electrolytic) Bars ... ,,	£49 12s. 6d.	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£59 12s. 6d.	...
d	,, ,, H.C. Wire per lb.	6½d.	½d. dec.
f	Ebonite Rod ... ... ,,	1/3 to 1/6	...
f	,, Sheet ... ... ,,	1/3 to 1/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine ... ... ,,	nom	...
h	India-rubber, Para fine ... ... ,,	4½d.	½d. Inc.
i	Iron, Pig (Cleveland No. 3) ... per ton.	58/6	...
l	,, Wire, galve. No. 1, P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£14 15s.	5s. Inc.
g	Mercury ... ... per bot.	£17s. to £17 10s.	...
e	Mica (in original cases) small ... per lb.	6d. to 8/6	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	8/6 to 17/6 & up	...
p	Phosphor Bronze, plain castings ,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	11d.	...
p	,, ,, rolled strip & sheet ,,	11¼d.	...
p	,, ,, wire ... ... ,,	1/0½d.	½d. Inc.
o	Platinum ... ... per oz.	£8	...
d	Silicium Bronze Wire ... ... per lb.	9½d.	...
r	Steel, magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£119 10s. to £120 10s.	£9 10s. Inc.
n	Wire, Nos. 1 to 16 ... ... per lb.	2/11d.	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
o Johnson, Matthey & Co.,
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Electricity Supply

Lighting, Domestic, Power

Aldershot.—LOANS.—The Town Council has applied for sanction to loans of £9,840 for mains and services, and £2,869 for meters.

Amble (Northumberland).—DOMESTIC ELECTRIFICATION.—The Urban District Council has approved a scheme which will provide for complete wiring installations on the deferred payment system and for the supply of electrical apparatus on hire and hire-purchase terms.

Argentina.—ROSARIO.—The *Review of the River Plate*, dated June 12th, states that the Municipal Intendent of Rosario has called for tenders to be presented within 90 days for the public lighting of the city. Tenderers are requested to make two types of offers: one for the supply of the energy for the public lighting and the construction of an underground system within the central radius; and another, for the supply of energy for the public lighting exclusively. The agreement at present in force between the Municipality and the Electric Light Company expires on November 13th, 1932.

Barnoldswick.—MAINS EXTENSIONS.—The Urban District Council has received sanction to a loan of £2,250 for the purpose of extending mains to the outer districts.

NEW SHOWROOMS.—New showrooms and offices are to be opened shortly at Barnoldswick, the conversion of the Council's property in St. James's Square for this purpose now being well in hand.

Barnstaple.—YEAR'S WORKING.—There was a net profit of £2,616 on the Corporation electricity undertaking for the past year. The revenue increased by £1,607 to £20,212, while the working expenses amounted to £10,578, as compared with £12,058. There was a gross profit of £9,634. It has now been possible to pay off the overdraft outstanding at the bank and for the first time for the last twenty years the undertaking has a credit balance—£680.

Birkenhead.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £3,721 for laying a main from Singleton Avenue to Prenton Bridge, and £7,972 for the provision of equipment for the supply to the Mersey Tunnel and to meet the increased load at Flaybrick Hill sub-station.

Birmingham.—GRIT EMISSION.—It was stated at a recent meeting of the Corporation Electric Supply Committee that £113,000 had been spent already by the Committee on plant designed to reduce the emission of grit from the power station. A complete cure for this trouble has not yet been found, but the Committee is hopeful that the result of the investigations recently made by a committee of expert engineers and chemists may indicate ways and means by which any cause for complaint in this connection may be removed.

Blackburn.—ASSISTED WIRING.—The Electricity Committee is convening a special meeting to consider the introduction of an assisted wiring scheme.

Bournemouth.—SUPPLY AGREEMENT EXTENDED.—The Town Council has decided to extend for a period of twenty-one years the right of the Bournemouth and Poole Electric Supply Co., Ltd., to supply electricity in the district. Among the conditions imposed by the Council is one providing for an immediate reduction in the lighting charge from 5½d. to 5d. per k'Wh, with corresponding reductions in other tariffs. The Corporation will also have the right to take over the undertaking at valuation at the end of ten years.

Bradford.—OFFER FOR UNDERTAKING REJECTED.—It is reported that the Corporation Electricity Committee recently received an offer from the lately-registered Electric and Gas Industries, Ltd., to purchase the municipal electricity undertaking for £2,000,000. After consideration the Committee recommended that the offer should be declined. Mr. R. A. Chattock, chairman of Electric & Gas Industries, Ltd., was at one time city electrical engineer of Bradford.

Bridlington.—YEAR'S WORKING.—The total revenue of the Corporation electricity undertaking for the past year amounted to £32,135, as compared with £30,617 in the previous year. Working expenses amounted to £16,148, as against £15,230, and there was a gross profit of £15,987 (£15,387).

LOANS.—Sanction has been received by the Corporation Electricity Committee to loans of £4,000 for unspecified mains and services, and £1,530 for the erection of a control sub-station in Brett Street.

Brighton.—NEW SUB-STATIONS.—The Corporation Electricity Committee is to provide a static sub-station and equipment for the extension of the supply to the Southwick and Portslade areas, at a cost of £8,000. A sub-station is also be erected in Longridge Avenue, Saltdean, at a cost of £1,550.

EXTENSIONS.—A supply is to be given to the Sewers Board at a cost of £2,100, to enable a ventilating fan to be operated electrically in close proximity to Ovingdean Village.

TIME SWITCHES.—The Electricity Committee has authorised the purchase of time switches for street lighting at a cost of £350.

Bromley.—YEAR'S WORKING.—We have received from Mr. W. G. Trend, borough electrical engineer, a copy of his annual report together with a statement of accounts of the electricity undertaking for the year ended March 31st last. The total

revenue amounted to £57,959, as compared with £48,680 in the preceding year, while the working expenditure increased from £28,282 to £32,592. There was a gross profit of £25,367, as against £20,398, and after providing for capital and other charges there remained a net surplus of £9,407, as compared with £4,814 in 1929-30. During the year £18,924 was expended on capital account, making a total of £202,146 now spent on the undertaking. Sales of electricity increased from 3,480,102 to 4,469,898 kWh and the maximum demand from 2,265 to 2,555 kW. The average price obtained per kWh fell from 3.27d. to 2.97d. Nearly seven miles of l.p. cables were laid and 660 new consumers were added during the year. The showroom showed a net profit of £400.

Bury St. Edmunds.—YEAR'S WORKING.—There was a net surplus of £2,438 on the Corporation electricity undertaking for the past year. Sales of electricity increased by 30 per cent., and 346 new consumers were connected. The average price obtained per kWh was 2.57d.

Cheltenham.—CHANGE-OVER.—At a recent meeting of the Corporation Electricity Committee the electrical engineer reported that a further section of the change-over had been carried out and that if the whole of this work could be carried out as anticipated, it would be possible to close down the power station next spring.

LOAN SANCTIONED.—Sanction has been received to a loan of £10,000 for mains and services.

Colchester.—YEAR'S WORKING.—An increase from £54,674 to £70,808 in revenue is recorded in the accounts of the Corporation Electricity Department for the year ended March 31st last. There was a net surplus of £632. Electricity sold rose by 1,348,199 kWh to 6,473,177 kWh, an increase of 26 per cent. The average price obtained per kWh was 2.532d., as against 2.479d. in 1929-30. New consumers numbered 2,624, making a total of 10,121 now connected.

Derby.—ASSISTED WIRING.—Over 1,600 application have been received for supplies under the Corporation's assisted wiring scheme, and sanction has been obtained to a loan of £10,000 to cover the cost.

Gravesend.—MAINS EXTENSIONS.—The Corporation Electricity Committee has obtained sanction to the borrowing of £6,540 for mains extensions in the Gravesend and Northfleet districts.

Hebden Bridge.—ASSISTED WIRING AND HIRE-PURCHASE.—The Urban District Council has decided to invite the local contractors to meet the Electricity Sub-Committee in order to discuss the question of assisted wiring and the hire-purchase of domestic electrical apparatus.

Hull.—STREET LIGHTING.—At a recent meeting of the Corporation Lighting Committee, the town clerk submitted a letter from the Ministry of Health, stating that the Minister had had under consideration the inspector's report into the application of the Corporation for sanction to the borrowing of £67,567 for the purpose of lighting the streets by electricity in substitution for gas. The Minister agreed that there was a need for improvement in the public lighting of the city, but he was not satisfied as to the advisability of a complete replacement of gas by electric lighting, and stated that while the lighting of the main roads could probably be carried out more efficiently by electricity, the lighting of the secondary roads might possibly more cheaply be made adequate by the use of more lamps and by improvement of the gas burners. In so far as the proposals related to the main roads, the Minister would, if the Council so desired, be prepared to give sanction to a loan on receipt of a revised application limited to such roads. The letter was referred to the chairman and the city engineer for consideration and report.

BREAKDOWNS.—Following the fourth alternator breakdown within a period of approximately five months, the Electricity Committee has authorised the engineer to engage the services of an expert in alternator design in order to ensure a reliable service for the coming winter.

Irish Free State.—THE SHANNON SCHEME.—The total cost of the Shannon Scheme up to June 30th last amounted to £5,719,350, according to details published with regard to Free State finances for the first quarter of the financial year 1931-32. A Bill providing for a sum of £250,000 to meet the requirements of the scheme is to be put through the Dail Eireann without delay. In the second reading of this Bill it is expected that Mr. P. McGilligan, Minister for Industry and Commerce, will make a statement reviewing the entire position in connection with the scheme and the Electricity Supply Board.

Kettering.—LOANS.—The Urban District Council is to apply for sanction to a loan of £4,000 for e.h.p. cable extensions. Sanction has been received to the borrowing of £1,484 for mains and £370 for plant, sub-station, and kiosk.

Leeds.—YEAR'S WORKING.—We have received from Mr C. Nelson Hefford, general manager and engineer of the Corporation Electricity Department, a copy of the annual report and accounts of the undertaking for the year ended March 31st last. The total revenue increased from £738,999 to £740,028 and the working expenditure from £282,494 to £297,853. The gross profit amounted to £442,176 (£456,505) and to this sum was added the profit on the showroom, installation and hire departments, making a total of £451,914 available. Loan charges absorbed £352,813 (an increase of £72,274) and other charges on revenue £47,509, which left a net profit on the year's working of £51,592, as compared with £119,134 in 1929-30. Against this profit £61,992 was charged as contribution to the capital expenditure of the year, leaving a deficit of £10,400, against which was set a sum of £11,917, surplus provision for income tax in previous years. This left a surplus profit of £1,516, as compared with £41,582 in the previous year. The capital expenditure during the year amounted to £558,489, the total now spent on the undertaking being £6,764,919. Sales of electricity totalled 147,114,486 kWh, as against 142,049,232 kWh, the principal increase being 4,379,790 kWh in residential bulk supplies; power consumption fell by 3,385,3.9 kWh. The simultaneous maximum load of the Whitehall Road and Kirkstall generating stations reached a total of 64,100 kWh during the year, as compared with 60,200 kW during the previous year at Whitehall Road. The work in connection with the Kirkstall station progressed to such an extent that it was found practicable to put it into partial operation on October 6th since when it has run with a gradually increasing load. Substantial reductions in prices were made from April 1st, 19.0, resulting in the average price per kWh sold declining from 1.22d. to 1.16d. Mains laid during the year amounted to 153 miles, making a total of 2,161, while new sub-stations and kiosks constructed and equipped totalled 29, bringing the total to 343. Satisfactory business was done in the installation department, the total number of installation carried out being 2,110. Of this number 1,100 were installed under the assisted wiring scheme and 1,010 for cash payment. The number of consumers increased during the year from 87,619 to 100,492, thus making Leeds the first undertaking in England to attain the hundred-thousand mark.

Leicester.—YEAR'S WORKING.—The accounts of the Corporation Electricity Department for the past year show a gross profit of £266,218. After providing for special expenditure (£20,861), interest and sinking fund (£146,206), and income tax (£18,440), there was a record net profit of £80,710, of which £10,000 is to be used for the relief of the rates. During nine months of the year consumers benefited to the extent of £16,400 through reductions in electricity charges.

Liverpool.—EXTENSIONS.—The Corporation Tramways and Electric Power and Lighting Committee has decided to carry out the following extensions: H.p. and l.p. mains from Bolton Street sub-station (£6,521), with sub-station equipment (£2,320); new switchboard at the Highfield Street sub-station and alterations to building (£1,000); mains extensions in the vicinity of Crosby Road South, Waterloo (£4,548), with new sub-station equipment (£1,500); mains extensions in the Beacon Lane area (£1,760), with sub-station equipment (£2,000).

LOANS.—Application has been made by the Committee for sanction to loans of £100,000 for sub-station plant and £50,000 for sub-station buildings.

London.—ST. MARYLEBONE.—The accounts of the Borough Council Electricity Department (engineer: Mr. C. H. Smyth) for the year ended March 31st last record an increase from £543,436 to £598,127 in the total revenue. Working expenses amounted to £380,253, as compared with £346,620 in the preceding year, the gross profit rising from £196,816 to £217,874. To this was added income from other sources making a total of £219,763, from which the following items had to be met: Interest on mortgage debt, £87,700; sinking fund, £105,087; other items, £23,103. There thus remained a net surplus of £3,873, which compares with a net deficiency of £14,739 in the previous year. The net capital expenditure during the year was £114,311, making a total of £3,472,668 now spent on the undertaking. There was an increase from 102,619,684 to 115,036,656 kWh in sales of electricity, the maximum load (including bulk supply) rising from 47,567 to 51,006 kW. The average price obtained per kWh fell from 1.189d. to 1.143d. The number of consumers showed an increase from 20,318 to 21,290.

SOUTHWARK.—The accounts of the Borough Council electricity undertaking show a net profit of £13,964. It is stated by the Electricity Committee that the year has been the most successful in the history of the Department.

Sanction has been obtained to a loan of £18,248 for mains extensions in connection with a scheme for the relief of unemployment. The wiring of staircases on the Manor estate, Penfold Place, at a cost of £438, on behalf of Mr. Claude M. Leigh, who is erecting blocks of dwellings, is recommended by the Electricity Committee.

The Committee recommends the provision of free wiring in certain cases. It is not proposed that the Council should commit itself to the principle of free wiring in each and every application, but that each case should be dealt with on its merits.

ELECTRICAL INSTALLATIONS.—The London County Council Housing Committee recommends that tenders be invited from selected firms for the wiring for electric lighting, heating and cooking in two blocks of dwellings in the Carlisle Street area, St. Marylebone.

Manchester.—PROGRESS DURING MAY.—During the month of May the Corporation electricity undertaking showed an increase of 2,518 kW in connections, bringing the total up to 447,717 kW. Applications received for supplies, including additional supplies, amounted to 1,286, representing a total of 3,320 kW. The number of hired cookers increased by 137, making a total of 7,764 now on circuit; applications for the hire of cookers numbered 155. Two new sub-stations were put into commission and new plant was installed at the Ancoats sub-station. The change-over from d.c. to a.c. had been com-

pleted in the cases of 15,112 up to May 31st, while work was in progress involving 1,699 consumers.

Northern Ireland.—BELFAST.—The report on the operation of the Corporation electricity undertaking for the year ended March 31st last records a gross profit of £226,562, to which was added £12,055 (share of interest on sinking funds), making a total of £238,617. After providing for loan charges (£163,117), interest on working capital (£2,165), income tax (£10,506), capital expenditure out of revenue (£1,109), and other small items amounting to £1,869, there remained a net surplus of £59,852. Electricity sold amounted to 69,010,850 kWh, an increase of 540,111 kWh on the preceding year.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

HORNSEY.—Shop-window lighting after business hours: First 100 kWh per quarter, 2d. per kWh; second 100 kWh, 1¾d.; above 200 kWh, 1½d. It is also recommended that a uniform charge of £1 per annum shall be made for all two-rate meters, with change-over switches up to and including the 10-A size, instead of the existing rents varying from £1 to £2 per annum, with a uniform charge of 7s. per annum for additional time switching apparatus when required.

WATFORD.—Lighting flat rate in the borough and Abbots Langley and Bushey: First 30 kWh in each of the two winter quarters, and the first 10 kWh in each of the two summer quarters, 5d. per kWh; beyond 2½d. Outside shop lighting: 2½d. per kWh. Two-rate lighting: All energy registered on the high rate meter at the lighting flat rate scale, and all registered on the low rate meter on the power and heating scale. Prepayment meter supplies: 6½d. per kWh. Two-part domestic tariff: "Unit" charge reduced to 0.45d. in the two winter quarters, and to ½d. in the two summer quarters, with a fixed annual charge of 12½ per cent. on the net rateable value, the minimum fixed annual charge being £4 12s. 6d. Water heating: ½d. per kWh. Special heating rate: First 1,000 kWh per quarter, 1d. per kWh; beyond, ¾d. Power and heating: Up to 1,000 kWh per quarter, 1½d.; up to 2,000, 1¾d.; up to 3,000, 1¼d.; up to 4,000, 1½d.; beyond, 1d. Meter rentals have been reduced by 33⅓ per cent. Corresponding reductions have also been made in the parish of Aldenham.

WINCHESTER.—General lighting flat rate in the city: From 6½d. to 6¼d. per kWh. Business premises, hotels, boarding houses, &c.: Alternative maximum demand tariff for lighting replaced by a two-part tariff with a fixed quarterly charge based on the maximum demand for lighting, plus 1d. per kWh for all electricity consumed for any use other than motive power; this is an alternative to the separate flat rate for lighting, cooking, heating, &c. Two-part domestic tariff: "Unit" charge reduced from 1½d. to 1d. Motive power flat rate: From 3d. to 2¾d. per kWh. Alternative maximum demand tariff for power: Replaced by a two-part tariff with a fixed quarterly charge based on the maximum demand, plus 1d. per kWh. Reductions have also been made in the charges in the rural districts.

SOUTHWARK.—Lighting: From 5d. per kWh for the first 1,200 kWh and 4d. for all over, to a flat rate of 4d.

BROMLEY (KENT).—All-in tariff for business premises: "Unit" charge reduced from 1d. to ¾d. All-in tariff for private premises: Charge on rateable value reduced from 10 per cent. to 8 per cent., and where an electric cooker or water heater is installed the "unit" charge lowered from 1d. to ¾d. Flat rate for cinemas: From 3½d. to 3d. per kWh.

BURNHAM-ON-SEA.—Lighting: First 80 kWh per quarter, 9d. per kWh; next 120 kWh, 8d.; above 200 kWh, 7d. Heating and cooking: First 40 kWh, 3d. per kWh; next 600 kWh, 1½d.; above 640 kWh, 1d.

BATLEY.—Power: Standing charge reduced from £4 to £3 10s. per kWh per annum.

Rotherham.—YEAR'S YORKING.—There was an increase from £143,114 to £151,511 in the gross profit of the Corporation Electricity Supply Department for the year ended March 31st last. After providing for loan charges, &c. (£113,601), there was a net profit of £29,514, as compared with £40,670 in 1929-30. In spite of an increase from 11,116 to 12,048 in the number of consumers, trade depression was responsible for a decrease of 14,716,128 kWh in the sales of electricity, the total energy sold amounting to only 97,222,659 kWh. It is anticipated that the Prince of Wales power station will be supplying electricity for the grid under temporary conditions about the end of the current year, but it is not expected that that station will be permanently taken over until about the end of the year 1933.

Salford.—LOAN.—The Corporation Electricity Committee recommends that application be made for sanction to a loan of £2,120 for the erection and equipment of sub-stations in Salford and Prestwich.

South Africa.—DOMESTIC ELECTRICITY CONSUMPTION.—A special investigation to determine the relative consumption of electricity in private dwellings in the twelve principal towns of South Africa was made in September last by the Union Census Office. The results of this investigation are now available in a special report. Johannesburg heads the list with 26,325 consumers, being followed by Capetown with 22,303, Durban 13,723, Pretoria 8,206, Port Elizabeth 6,033, Bloemfontein 2,834, Kimberley 2,826, East London 2,340, Germiston 2,282, Maritzburg 1,858, Benoni 1,108 and Krugersdorp 564. The report covers altogether 90,402 householders, and these between them are seen to have consumed 8,134,368 kWh of energy during the month of September, representing an average consumption of 90 kWh per household. The total amount spent on electricity during the month was £65,445, which works out at just under 2d. per kWh. While in Durban each consumer used on an average 235.2 kWh, the figure in the case of Capetown was only 61.5 kWh, and in Germiston only 31.1 kWh. Energy was cheapest in Durban at just under 1d. per kWh, while it was 1.7d. in Maritzburg, 1.8d. in Bloemfontein, 1.9d. in Pretoria, 2d. in Port Elizabeth, 2.7d. in Capetown, 2.8d. in Johannesburg and East London, over 3d. in Germiston and Krugersdorp and nearly 5d. in Kimberley.

South Shields.—YEAR'S WORKING.—A net profit of £6,865 is shown in a preliminary statement on the working of the Corporation Electricity Department for the year ended March 31st last. Revenue totalled £112,807, as against £110,276 for the preceding year. The Electricity Committee has decided to place the surplus to the credit of the special reserve fund which at present stands at £51,036. Energy sold amounted to 11,352,982 kWh, a decrease of 5.9 per cent.

Warrington.—PROPOSED NEW SHOWROOMS.—The Corporation proposes to erect new showrooms for the Electricity, Gas and Tramways Departments in Buttermarket Street.

West Hartlepool.—YEAR'S WORKING.—A loss of £1,679 during the past year's working is reported on the Corporation electricity undertaking. A few months ago it was feared that the loss would reach £6,000 and the Corporation therefore decided to increase the charges for electricity. The cessation of the demand from the South Durham Steel & Iron Co., Ltd., has been responsible for a decrease in the sales of electricity of about 6,000,000 kWh. A loss of £1,560 was reported on the railless-car system.

West Midlands.—ADVISORY JOINT COMMITTEE'S REPORT.—The annual report of the Committee for the year ended March 31st last states that the installation of the 30,000-kW turbo-alternator and steam raising plant at Stourport power station proceeded satisfactorily, and it is anticipated that the new generator will be in commission early in the present year. Satisfactory progress was also made with the installation of a 30,000-kW set at Hams Hall power station and a 25,000-kW set at Prince's power station, Nechells, and it is expected that they will both be ready to be put into commercial use by the coming autumn. During the year under review a further considerable amount of capital was provided by the constituent undertakers for extending supplies to those parts of their supply areas not already served. In the Warwickshire portion of the Birmingham Corporation's area of supply 27½ miles of distributors and 42¼ miles of e.h.p. lines were established during the year, making the total mileage to date 113¾ miles of distributors and 91 miles of e.h.p. lines, outside the boundaries of the city. In addition 21 additional transformer centres were established, making a total to date of 51. In the portion of the Shropshire, Worcestershire and Staffordshire Electric Power Co.'s area of supply within the district, supplies (involving approximately 23 miles of distributors) were given for the first time in twenty-seven small townships and villages. Supplies were also given to a number of villages outside the South-West Midlands district from sources within the district. An appreciable amount of work in connection with the change of frequency was carried out, in addition to the very considerable task of preparing inventories of the consumers' plant and apparatus and detailed arrangements for change-over with such consumers. The prevailing trade depression was responsible for a decline from 479,181,989 to 476,411,111 kWh in the sales of electricity, the maximum demand falling from 220,116 to 219,085 kW. The number of consumers at March 31st last was 141,050, an increase of 25,657 during the year.

York.—RURAL ELECTRIFICATION.—Members of the City Electricity Committee on June 30th made a tour of the supply area, which covers the region within a radius of about 15 miles of the city. The Corporation has embarked on a considerable extension of rural electricity service, and the occasion was the inauguration of the first part of the scheme, including the extension of supply from Stockton-on-Forest to Stamford Bridge, through Warthill and Gate Helmsley. Alderman C. W. Shipley, chairman of the Committee, switched on the transformer at the sub-station at Stockton-on-Forest and again at Stamford Bridge. Mr. M. H. Wilson, managing director of Messrs. Johnson & Phillips, Ltd., the contractors, presented the chairman with a reading lamp as a memento of the occasion. The second area, which was also inspected, but not actually ready for inauguration, involves the construction of h.p. lines, which are now well advanced, from Wigginton to Sutton-on-Forest, Huby, Stillington, Alne and Tollerton. These lines are also to be extended across the river to supply Great and Little Ouseburn, Whitby, Kirk Hammerton, and Green Hammerton, where they will join the line from the hydro-electric station at Linton Lock.

YEAR'S WORKING.—For the year ended March 31st last the Corporation Electricity Department's income was £175,518, an increase of £19,853 on the preceding year. Working expenses amounted to £92,368, as against £86,738, and there was a gross profit of £83,150 (£68,926). After paying loan charges, &c., there was a net surplus of £29,404. Electricity sold totalled 32,096,488 kWh, an increase of 4,349,837 kWh on the previous year. New consumers connected numbered 2,374, making a total of 14,671.

LOAN.—The Electricity Committee recommends that application should be made for sanction to loans of £8,000 for assisted wiring installations, and £45,000 for mains and services.

Traction

Accrington.—YEAR'S WORKING.—The Corporation tramways show a net loss of £2,414 for the past year.

Burnley.—YEAR'S WORKING.—In his report on the working of the Corporation Tramways and Omnibuses Department for the past year, Mr. Chas. H. Stafford, general manager, states that there was a gross revenue on the tramways of £140,747, a decrease of £15,877 as compared with the preceding year. Working expenses, however, also fell from £128,697 to £121,276, the gross profit amounting to £19,471 (£27,927). After providing for loan charges, sinking fund, income tax, &c., there was a net profit of £69, as compared with £7,975 in the previous year. The capital expenditure during the year amounted to £7,234. The number of passengers carried decreased from 23,545,990 to 21,222,423 and the car-mileage from 2,143,953 to 1,983,789. The total revenue per car-mile fell from 17.53d. to 17.08d.

Carlisle. — CORPORATION'S APPLICATION REFUSED. — The Northern Area Traffic Commissioners have refused to grant the application made by the Corporation for permission to purchase the existing privately-owned tramway system in the city area and eventually scrap it and substitute a 'bus service.

Continental.—ITALY.—The construction of railless cars has recently been commenced in Italy by the Società Nazionale delle Officine di Savigliano of Turin.

SWITZERLAND.—According to a recent estimate of the passenger traffic in Switzerland, 50 per cent. is dealt with by electric tramways, 38 per cent. by the railways, just over 2 per cent. by motor 'buses and coaches, and about 9 per cent. by private cars.

Coventry.—YEAR'S WORKING.—There was a net deficiency of £8,846 on the Corporation tramways for the past year. The number of passengers carried decreased from 15,054,013 to 14,460,329.

Darlington.—RAILLESS CARS.—The transport manager has been instructed by the Corporation to obtain tenders for the supply of overhead equipment for the proposed new railless-car route along Coniscliffe Road. With regard to the Corporation's application for extended routes for the railless-car service, the United Automobile Services, Ltd., has withdrawn its opposition to the plan and it is expected that the Corporation will receive sanction to the extensions shortly.

Liverpool.—YEAR'S WORKING.—The Corporation tramways show a net profit of £85,577 for the year 1930-31, as compared with £123,627 in the previous year.

NEW TRAMWAY ROUTES.—The Corporation Tramway Committee has made arrangements for the laying of tramway track along Beloe Street, Toxteth. It is also proposed to extend the tramway system along Marybone, Bevinton Hill, and Brownlow Hill as soon as these thoroughfares have been widened.

London.—AUTOMATIC TRAFFIC CONTROL.—A successful test of the automatic traffic control system in Oxford Street was made last Sunday and it is probable that the permanent change-over to the automatic system will take place at an early date.

Luton.—SALE OF TRAMWAY FORBIDDEN.—The Minister of Transport has refused to give his consent to the transfer of the Corporation tramway undertaking to the Eastern National Omnibus Co., Ltd., for a sum of £64,000, and to the Corporation entering into an agreement not to institute competitive transport for 21 years. The Minister states that the Tramways Act of 1870 does not permit an agreement such as that proposed.

Newcastle-upon-Tyne.—TRAMWAYS TO BE ABANDONED.—At a meeting of the Northern Area Traffic Commissioners it was disclosed that the Corporation is to abandon its tramway system involving 300 tramcars in two or three years time when the existing tramway track has been worn out.

PROPOSED REMOVAL OF TRAMWAY TERMINUS.—The Corporation Transport Committee has intimated to the Watch Committee that it disapproves of the proposal to remove the tramway terminus from the Central Station to Marlborough Crescent.

Siam.—RAILWAY ELECTRIFICATION.—A Swedish engineer, Mr. J. F. Hagerup, has been engaged by the Siamese Government to make a survey of the water power resources of that country as a preliminary step towards the future electrification of its railways.

Stalybridge.—RAILLESS CARS.—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board is considering the introduction of railless cars on certain routes.

Wolverhampton.—YEAR'S WORKING.—The report on the working of the Corporation railless-car undertaking (general manager and engineer: Mr. C. Owen Silvers) for the year ended March 31st last records a total revenue of £181,772 and a working expenditure of £112,681, leaving a gross profit of £69,091. The previous year's figures were: Income £179,915; working expenses, £104,643; gross profit, £75,272. To the gross profit was added £21,250 from the motor-omnibus account as well as sundry other smaller items, making a total of £90,631 available. After providing for loan interest (£21,931), sinking fund (£38,841), income tax (£13,200), &c., there remained a net surplus of £8,177, which compares with £14,380 in the preceding year. Capital expended on the transport undertaking during the year totalled £49,773, of which the principal item (£24,994) was for land and buildings. The number of passengers carried by the railless cars increased from 23,175,998 to 25,143,810 and the car-mileage from 2,419,762 to 2,616,000. The total revenue per car-mile decreased from 17.847d. to 16.672d.

Telegraph and Telephone

France.—RADIO-TELEPHONY.—Direct wireless telephone communication between France and Algeria is expected to be available by the end of the year. At both Paris and Algiers there will be two transmitting sets capable of allowing four conversations and two telegraph messages to be transmitted simultaneously during sixteen hours of the day. During seven hours the line will be available for two telephone and one telegraph message, the remaining hour of the 24 being devoted to testing and the adjustment of the apparatus.

International Telephony.—ENGLAND-SARDINIA.—The newly-established service between this country and Sardinia is available between London and the towns of Cagliari, Nuoro, Ozieri, and Sassari. The radio link between Rome and the island was established on July 2nd.

LONDON-JUGOSLAVIA.—The first direct conversation between London and Jugoslavia took place recently and a regular service will be inaugurated shortly.—*Reuter* (Belgrade).

Spain.—TELEPHONE OPERATORS.—Threats were made to disorganise the telephone system on Saturday last if the company which controls the national system did not accede to the men's demand. The service has been practically normal, thanks to the inspectors and officials of the company who have been attending to the mechanical side. Moreover numbers of girl operators reported for duty, and were conveyed to and from their homes in covered motor lorries. In the provinces the strike was only partially successful, apart from Barcelona and Valencia, the headquarters of the Syndicalist movement. The strike has a pronounced political aspect.—*Reuter* (Madrid).

The Telephone Service.—MEDICAL PROFESSION'S USE.—That every practising doctor in the country now has a telephone is the claim of the Post Office authorities. As the result of their recent intensive campaign, 12,500 medical men who were not equipped with telephones were persuaded to have them installed and it is also stated that orders have been placed for 500 extension telephones to bedrooms and surgeries. It is estimated that 25,000 doctors are practising in this country.

Radio

Australia.—LICENCES.—Returns for April show that there were 329,134 licences in force in the Commonwealth, an increase of 969. Cancellations numbered 5,337, but were more than counter-balanced with 6,306 new licences. New South Wales had 120,612, only 17,540 behind Victoria's total of 138,152. In N.S.W. there were 1,552 cancellations, but 2,505 new issues, an increase of 953. Victoria lost 868 licences; new issues totalled 2,012, but there were 2,880 cancellations. Figures for the other States were: Queensland, 24,542 (increase 210); South Australia, 29,205 (increase 402); West Australia, 8,645 (increase 195); Tasmania, 7,978 (increase 77).

Canada.—DOMINION CONTROL.—The Supreme Court at Ottawa delivered judgment on June 30th on the respective rights of the Dominion and the provinces to control broadcasting, an issue raised by the Provincial Government of Quebec. The Court held by a majority of three to two that control was vested in the Dominion Parliament and not the Provincial Legislatures on the ground of "convenience amounting to necessity." According to *The Times* it is probable that the Quebec Government will appeal to the Privy Council.

Radio Interference. — INVESTIGATIONS. — The Postmaster-General has informed the Radio Association that he does not feel justified in setting up a committee, as suggested by the Association, to comprise members of the power companies, tramway systems, and listeners' organisations throughout the country to discuss radio interference by electric trolley omnibuses. However, a joint investigation is at present being actively pursued by the Post Office, the British Broadcasting Corporation, and representatives of the various omnibus and tramway undertakings and the Post Office is in communication with the Electricity Commissioners as regards the legal position of power companies to take action when a consumer causes interference with wireless reception.

Relay Exchanges.—NEW P.O. CONDITIONS.—The possibility that the Post Office may buy out all the wireless relay "exchanges" and operate them as part of the Post Office telephone service is suggested by the provision of a clause in the licence now being issued for the establishment of such exchanges, which states that the Postmaster-General shall have the right of purchase on "tramway terms" on three months' notice expiring December 31st, 1932, or at the end of any subsequent year. The right covers the acquisition of all apparatus at the central receiving station, any distributing wires, and any apparatus used by subscribers to the exchange system. "Tramway terms" means purchase at current valuation without compensation for goodwill, loss of profits, or any other consideration whatsoever. Among other provisions in the agreement are: that a list of subscribers to the wireless exchange shall be submitted monthly to the Post Office; that each subscriber shall hold a separate receiving licence; that distributing wires must be erected as far as possible remote from, or at right angles to, existing telephone and telegraph wires and aerials. As a general rule the agreement also prohibits the use of Post Office telephone lines for distribution wires.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Belgium.—BRUSSELS.—July 22nd. Belgian Telegraph and Telephone Authorities. Supply and laying of a quantity of telephone cable. Particulars (Cahier des Charges Spécial No. 3-561) for 18 francs from Régie des Télégraphes et des Téléphones, Brussels.

July 29th. Telephone cables and accessories for Tervueren, Haecht, Opwyck, Cortenberg, Landen, Saint-Trond, Bree, Neerpelt, Hove, Contich, Remixem, Lierre, Athus, and Longlier. Particulars (Cahier des Charges Special No. 3-565) for 7 francs 60 centimes from Régie des Télégraphes et des Téléphones, Brussels.

Carlisle.—July 17th. Electricity Department. 11,000-V overhead transmission line in connection with a supply to rural districts. (June 26th.)

Dunfermline.—July 13th. Town Council. Electric lighting at housing scheme. Schedules from burgh engineer (deposit £1 1s.).

Egypt.—CAIRO.—August 24th. Ministry of the Interior. Electric lighting installation for the town of Akhmim, near Sohag. (A.X. 10970.)*

August 20th. Two step-down power transformers of 50 kVA and accessories for the Assiout power station. (A.X. 10985.)*

September 2nd. 125-kVA motor generator, Diesel engine, switchboard, &c., for Delta Barrage spinning factory. (A.X. 10984.)*

August 3rd. 600 meters of various kinds for Menond and Kafr-el-Cheikh. (A.X. 11004.)*

August 13th. One 40-kVA and one 20-kVA air-cooled three-phase transformer for Zifta Municipality. (A.X. 11001.)*

Girvan.—Town Council. Various works, including electric lighting. Applications to Mr. S. Valentine, town clerk.

Glasgow.—August 12th. Gas Department. Static condensers. (See this issue.)

Irish Free State.—KILDARE.—July 17th. Board of Health. Electric lighting in connection with the conversion of Firmount House into County Sanatorium. Particulars from Mr. D. J. Purcell, secretary, County Hospital, Naas.

SLIGO.—July 14th. Sligo District Mental Hospital Committee. Electric wiring for lighting of hospital. Specification and form of tender from the clerk, Mental Hospital, Sligo.

Kirkwall (ORKNEY).—July 15th. Electric lighting installation for housing scheme. Specifications from burgh surveyor.

Leeds.—July 23rd. City Libraries and Arts Committee. Electric lighting installation at Sheepscar, Headingley, Chapel Allerton and Holbeck Branch Libraries. Specifications from Mr. J. E. Ackfield, city engineer, Municipal Buildings.

London.—CENTRAL ELECTRICITY BOARD.—July 20th. Central indication and telephone equipments for the Mid-East England Electricity Scheme. (June 19th.)

OFFICE OF WORKS.—July 23rd. (a) Mechanical, and (b) electrical engineering labour in Manchester district. (July 3rd.)

Manchester.—July 13th. Electricity Department. Prepayment meters. (July 3rd.)

July 14th. Transport Committee. Cadmium copper trolley wire. Specification and form of tender from the general manager, Corporation Transport Department, 55, Piccadilly, Manchester.

Newmilns and Greenholm (Ayrshire).—July 18th. Town Council. Electric wiring for housing scheme. Specification from Mr. J. H. Gilmour, burgh surveyor.

New Zealand.—WELLINGTON.—Post and Telegraph Department. August 28th. 500 microtelephone handles. (A.X. 10980.)*

Ogmore and Garw.—July 24th. Electricity Department. Alterations to an existing 11,000-V overhead transmission line. (See this issue.)

Panama.—Diesel-electric generating plant developing 100 to 125 h.p. (G.X. 10521.)*

South Africa.—JOHANNESBURG.—City Council. July 23rd. Electrically-operated automatic signals (A.X. 10981)*; and street lighting time switches (A.X. 10982.)*

July 23rd. 42 single-rate meters and 42 two-rate meters. (A.X. 10976.)*

KLERKSDORP.—August 7th. Municipal Council. Power station and distribution network. (A.X. 10983.)*

DURBAN.—July 31st. Corporation. Four 500-kVA transformers. (A.X. 10999.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Bath.—The Building & Colliery Supply Co., Ltd., has received a contract for the electrical work (£5,019) at the Royal United Hospital.

Beckenham.—Urban District Council. Accepted:—
Electrical heating installation at the new municipal buildings, exclusive of wiring (£3,897).—Young, Osmond and Young, Ltd.
Electric wiring of municipal buildings (£4,313).—Mansell, Jarrett & Co.

Birmingham.—Gas Committee. Accepted:—
Erection of electric telpher at Adderley Street gasworks.—Strachan & Henshaw, Ltd.

Salvage Committee. Accepted:—
Electric vehicle batteries.—Britannia Batteries, Ltd.; Chloride Electrical Storage Co., Ltd.; Tudor Accumulator Co., Ltd.; D.P. Battery Co., Ltd.
Magnetic separator equipment at salvage depot.—Rapid Magnetting Machine Co., Ltd.
Baths Committee. Accepted:—
Electric lighting installation at Sparkhill baths.—Solihull Electrical Services.
Education Committee. Accepted:—
Electrical installations at schools:—Conway Road.—Davis and Millward; Bushmore Farm and Highters Heath schools.—T. Glover; Kelby Close school.—Ellis & Ward, Ltd.; Erdington secondary school.—R. H. Newton; Elkington Street school.—Walker Bros.
Health Committee. Accepted:—
Electric lighting at Dudley Road hospital.—W. L. Horrobin.
Works Committee. Accepted:—
Re-wiring at Vestry Hall, Islington Road.—Parker, Winder and Achurch, Ltd.
Re-wiring at Assistance offices, Edmund Street.—Stuart Electrical Co., Ltd.
Electricity Committee. Accepted during past quarter:—
Supply and laying of cables.—Callender's Cable & Construction Co., Ltd.
Rotary convertors for Bourneville and King's Heath substations and reconstruction of rotary convertors at King's Heath sub-station.—Electric Construction Co., Ltd.
Rectifier equipment at five sub-stations.—Hewittic Electric Co., Ltd.
Storage battery repairs at three sub-stations.—Tudor Accumulator Co., Ltd.
Turbo-alternator and condensing plant at Ham's Hall power station and also at Nechells station; switchgear at six sub-stations and supply of transformers.—General Electric Co., Ltd.
Transformers.—English Electric Co., Ltd.; Crompton Parkinson, Ltd.

Bradford.—Baths Committee. Recommended:—
Windsor Halls (Public Baths) extensions: Electric lighting.—Collinson Bros., Ltd. (£165); installation of electric lift.—Reliance Lift & Engineering Co., Ltd. (£532).
Electricity Committee. Recommended:—
Complementary gear to existing skeleton feeder equipment at Valley Road generating station in connection with extension of e.h.p. mains to Dudley Hill.—A. Reyrolle and Co., Ltd.
Steam piping for two new boilers at Valley Road station.—Aiton & Co., Ltd.
Two de-superheaters for Nos. 5 and 6 turbines.—Crosby Valve and Engineering Co., Ltd.
Education Committee. Recommended:—
Electric lighting at schools: Bowling Back Lane (£275).—J. Carter; Clayton (£196) and Wisbey (£423).—H. Ashworth; Lilycroft (£308) and Undercliffe (£225).—N. Walker.

Bury.—Town Council. Accepted:—
Two kiosks for Springs and Woodhill sub-stations.—Metropolitan-Vickers Electrical Co., Ltd.
One 750-kW transformer for Tithebarn Street sub-station.—Bruce Peebles & Co., Ltd.

Cheltenham.—Electricity Committee. Accepted:—
Cables for 12 months.—Hackbridge Cable Co., Ltd.
Extension of main (£197).—F. G. Hanney & Sons.

Dartford.—Electricity Committee. Recommended:—
Two steel kiosk sub-stations at Baldwyns and Maypole estate (£704); 235-kVA transformer (£124); and transformer kiosk at Temple Hill (£210).—Crompton Parkinson, Ltd.
Cables joint baxes, &c., for supply to Maypole & Baldwyns estates (£1,969).—Johnson & Phillips, Ltd.

Eastbourne.—Watch Committee. Accepted:—
Street fire alarm system (£531).—Walters Electrical Manufacturing Co., Ltd.

Lamp Contract.—The Union Castle Mail Steamship Co., Ltd., has placed a contract with Siemens Electric Lamps & Supplies, Ltd., for a supply of vacuum and gasfilled lamps. The Union Castle Co. has also placed a contract with the British Thomson-Houston Co., Ltd., for electric lamps.

Liverpool.—Electric Power and Lighting Committee. Accepted:—
Direct-driven air compressor for boiler and general purposes (£359).—Alley & McLellan, Ltd.
Eighteen 750-kVA transformers (£243 each).—Metropolitan-Vickers Electrical Co., Ltd.
Port Sanitary and Hospitals Committee. Accepted:—
Installation of a private telephone system at the Alder Hey Hospital (£812).—Standard Telephones & Cables, Ltd.

London.—SOUTHWARK.—Electricity Committee. Accepted:—
Battery plates (£254).—Alton Battery Co., Ltd.

Maidenhead.—Town Council. Accepted:—
Wiring 20 houses for electric lighting.—W. N. Bishop.

Manchester.—Electricity Committee. Accepted.—
Twelve months' supplies to June 30th, 1932:—
Transformers.—Ferranti, Ltd.
Time switches.—Nathan & Allen, Ltd.; Venner Time Switches, Ltd.
A.c. meters.—Ferranti, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Measurement, Ltd.
Electric kettles.—Premier Electric Heaters, Ltd.

Cables.—Derby Cables, Ltd.; Metropolitan Electric Cable and Construction Co., Ltd.; Connollys (Blackley) Ltd.; Hackbridge Cable Co., Ltd.; Macintosh Cable Co., Ltd.; W. T. Glover & Co., Ltd.; Power & Lighting Cables, Ltd.; Croydon Cable Works, Ltd.; Edison Swan Cables, Ltd.; Johnson & Phillips, Ltd.; Standard Telephones and Cables, Ltd.; Callender's Cable & Construction Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; British Insulated Cables, Ltd.; Liverpool Electric Cable Co., Ltd.; Siemens Bros. & Co., Ltd.; Mersey Cable Works, Ltd.; L. Andrew & Co.; Pirelli-General Cable Works, Ltd.; Ward & Goldstone, Ltd.

Electric motors.—Asea Electric, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Laurence, Scott & Electromotors, Ltd.

Sleaford.—Urban District Council. Accepted:—

Suspension street lamps (£144).—Wardle Engineering Co., Ltd.

Sowerby Bridge.—Urban District Council. Accepted:—

Installation of electric lighting in 16 houses at Beechwood.—J. Quain.

Tendring.—Essex C.C. Assistance Committee. Recommended:—

Electric lighting at Institution (£624).—Dean & Gosling.

Warrington.—Electricity Committee. Accepted:—

Sub-station switchgear.—Harland Engineering Co., Ltd.

One spare exciter armature.—Brush Electrical Engineering Co., Ltd.

Forthcoming Events

Society of Chemical Industry.—July 13th-18th. London. Jubilee celebrations and exhibition.

Institution of Electrical Engineers (London Students' Section).—July 18th-28th. Italy and Switzerland. Summer meeting.

International Congress of Radiology.—July 26th-31st. Sorbonne, Paris.

Electrical Association for Women.—Tuesday, July 21st. 1.45 p.m. Visit to the L.C.C. central tramcar repair depôt, Greenwich.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following :—

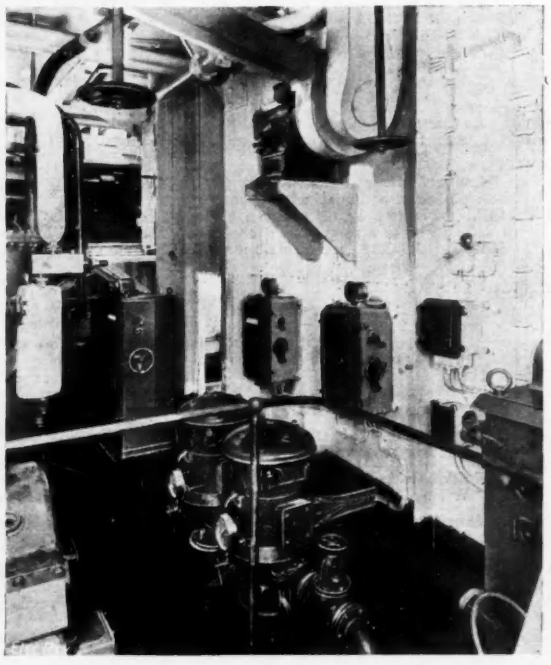
BRITANNIA electric fire.

British agents for NOARK cartridge fuses.

Notes

Motor Control on Ship-board

The accompanying illustration shows the method of controlling the CO_2 machines and brine pumps for the refrigerating plant on the s.s. *Empress of Britain*. The control gear on this vessel, the major portion of which were supplied by Allen West & Co., Ltd., includes starters for motors in the kitchen, contactor controllers for the ventilating fans (120 of which are controlled from a central board), and control pillars of all sizes for forced and induced-draught fans, pumps, and machine tools, and also the motor-operated drum controllers for the cranes, turbine-turning gear, davits, and laundry machinery. Control pillars for use with motors up to 10 h.p. are enclosed in cast-iron cases, and for larger sizes are of the pillar type, either fixed to the bulk-head or deck-mounted. Similar apparatus has been supplied by the same firm to the C.P.S. vessels *Empress of Japan*, *Princess Helene*, and *Beaverhill*.



I.E.E. Conversazione and Summer Meeting

Although particulars of the arrangements for the annual conversazione and the summer meeting for 1931 were sent to members last May, it appears from the inquiries which are being received by the secretary that a number of members have overlooked the information then given. Members are therefore reminded that the annual conversazione will this year be held at the Royal Albert Hall, London, on Tuesday evening, September 22nd, and that the summer meeting, for which an extensive programme of visits has been arranged, will take place in London also from Tuesday, September 22nd, to Friday, September 25th, the programme concluding with a ball at Grosvenor House, Park Lane. Members interested in the summer meeting should apply without delay to the secretary for particulars, which are set out on page 748 of our May 1st issue.

Water-heater Demonstration Equipment

An installation which has just been completed at the electricity showrooms of the Cardiff Corporation permits of the demonstration of a number of different types of water-heaters at the same time, thus illustrating to prospective customers the characteristics and comparative working cost of each type. A steel framework has been erected for the accommodation of the appliances, and a switchboard is fitted alongside it equipped with three-heat control switches for the heaters and an ammeter with cost-per-hour readings. A feature of the installation is the ease with which the heaters being demonstrated can be changed for others. The adjustable framework can be adapted to equipment of any size, and all the essential water connections are readily detachable.

The Champsec Power Station

A new hydro-electric power station known as "Champsec" has lately been completed by the Power Supply Co. of Western Switzerland (E.O.S.). It is situated in the canton of Valais and utilises a head of about 1,800 ft. between the village of Fionnay and Champsec. The pressure pipe line, which is 4,100 ft. long, was supplied by Sulzer Gebruder, of Winterthur, and consists of electrically-welded pipes dimensioned to conduct from 88 to 105 cu. ft. of water per second. The equipment of the power station consists of four sets, three of them having so far been installed. Each comprises a Pelton turbine built by the Ateliers des Charmilles, Geneva, directly coupled to an Oerlikon generator of 4,500 kVA, 10,000 volts, 50 cycles, which is coupled to the bus-bars through a step-up transformer of 10,000/64,000 V. The whole power generated, apart from that required for the local supply, is transmitted by a single line to the switching and distribution station of the E.O.S. at Vorziers. With a load of 4,500 kVA at a power factor of 0.8, an efficiency of 95.35 per cent. was obtained, as against the guaranteed 94.5 per cent. The generators are protected only by overload relays mounted directly on the bushings of the oil circuit breakers of the high-voltage line. As synchronising is done on the 10-kV side, neither current nor potential transformers are required on the 64-kV side.

Leeds Electrical Club

The Leeds Electrical Club will hold its annual "field day" on Thursday, July 16th, at Roundhay Park, Leeds. During the afternoon a cricket match will be played between the Leeds Electrical Club and the Sheffield Electrical Club. Tea will be served in the mansion at 6.15 p.m. and will be followed by a bowls match. The evening will be completed by a smoking concert, commencing at 8.15 p.m. Any friends in the electrical industry will be welcome, the price of the tickets being 5s. 6d., obtainable from Mr. Fred. Dawson, hon. sec., 9, Mill Hill, Leeds.

Appointments Vacant

General engineer, refrigeration engineer, electrical engineer, and superintendent of cold storage for Liverpool Corporation Markets Committee.

Clerk and assistant clerk of the works at Guy's Hospital.

Lecturer in electrical machine design for the Regent Street Polytechnic.

Assistant station engineer for Royal Arsenal power station, Woolwich.

(See our advertisement pages to-day.)

Educational

The ROYAL TECHNICAL COLLEGE, Glasgow.—Complete courses of instruction are provided in all branches of mechanical, electrical, civil, mining and chemical engineering. A copy of the prospectus may be obtained from the secretary.

(See our advertisement pages to-day.)

O.L.A. Conversazione

The annual conversazione of the Overhead Lines Association is to be held on the evening of Friday, October 12th. The time and place will be announced later.

Illumination Congress Banquet

Mr. C. C. Paterson, president of the International Commission on Illumination, will preside at a banquet to be given to the delegates from abroad attending the meetings of the International Commission on Illumination and the International Illumination Congress, and a number of distinguished guests have been invited to meet them. It is hoped that all

those associated with the lighting industry in Great Britain will make a special effort to support the president by their presence on that occasion, and will bring with them as guests ladies or gentlemen who are in sympathy with the aims and objects of the Congress. The banquet will be held at the Dorchester Hotel, Park Lane, W.1, on Wednesday, September 2nd, and will terminate at 10 p.m. promptly, in order to enable the delegates to take part in a tour of inspection of street lighting. The tickets will be 42s. each, inclusive of wines, obtainable from Mr. J. S. Dow, 32, Victoria Street, S.W.1, preferably not later than July 15th.

I.E.E. Students Premiums

The Council of the Institution of Electrical Engineers has awarded the following premiums for students' papers for the session 130-931:—Premiums (value £10) to Mr. L. S. Crutch (London), Mr. E. R. L. Fitzpayne (Edinburgh), and Mr. J. Randle (Manchester); and premiums (value £5) to Mr. E. N. Cunliffe (Newcastle-on-Tyne), Mr. G. H. Halton (Stourport, Worcs.), Mr. H. Hirst (Sheffield), Messrs. M. G. Holmes and L. F. Salter (London), Mr. R. MacWhirter (Glasgow), Mr. H. Pickard (Leeds), Mr. F. L. Turnbull (Newcastle-on-Tyne), Mr. C. J. F. Tweed (London). The Council has awarded a prize, value £5, to Mr. C. M. Johnston for a paper on "The Relations between Economics and Engineering," submitted by him in competition for "The Students' Prize" for session 1930-31. A further prize of £5 will be awarded next session for the best paper on the same subject.

Mining Engineers' Summer Meeting Postponed

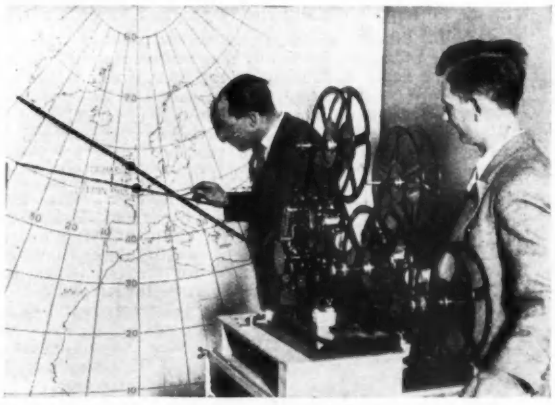
The secretary of the Institution of Mining Engineers informs us that, owing to the present exacting demands upon the time of members, the summer general meeting which had been arranged for July 8th, 9th and 10th, at Manchester, had to be postponed.

Station Control in Norway

In the south-eastern portion of Norway, particularly the districts on both sides of the Oslo Fiord, which constitute the most important agricultural and industrial area of the country, power requirements are almost exclusively furnished by hydro-electric stations. East of the fiord, the largest river (the Glomma) feeds a number of low-head generating plants, the installations on the western side of the fiord being mainly high-head stations with large water reservoirs. The stations have a total capacity of approximately 500,000 kVA, generating about 3,000 million kWh annually. So extensive a system needs central supervisory and load-dispatching facilities; telephony does not suffice, for the officials on duty must always have a clear picture of the operating conditions. Central control of the eastern part of Norway has been established in Smestad, a suburb of Oslo, and its importance has steadily increased since its inception. The remote signalling equipment enables an illuminated circuit diagram to correspond automatically with the state of the system, the illumination of the symbols depending upon whether the actual counterparts in the network which they represent are live or dead. The remote control and signalling apparatus was constructed by the Siemens & Halske Co., of Berlin. When the position of an indicator corresponds to that of the switch it represents the light is steady, but when it does not correspond the light flickers. In this way no incoming signal can be overlooked, as it remains in operation until the engineer in charge has taken note of, and confirmed the signal. Each switch-position indicator on the illuminated diagram is surrounded by a concentric ring coupled to the control switch. By merely pressing the ring slightly at right angles to the surface of the board and then turning it to the left or right, remote metering apparatus indicates outputs and voltages at various points in the system to the load dispatcher, who also has telephone facilities, including high-frequency telephony along the power cables. In the city the cables for remote signalling are laid parallel to the 30-V cables, and metering and telephone operations, although acting concurrently, do not interfere with one another.

Thunderstorm Research

Included in the work of the Radio Research Board at Slough, Bucks., is investigation into the origin and source of thunderstorms. The apparatus employed for the purpose includes a sensitive radio direction finder and a cathode-ray



oscillograph. Records of lightning disturbance are made on kinematograph film which, together with a similar film made at exactly the same time at Leuchars, in Scotland, is projected on to a large map of the world as indicated by the accompanying illustration in order to locate the area of origin of a thunderstorm.

New Standard Heat Symbols

New tentative standard symbols for heat and thermodynamics have been approved by the American Standards Association, which co-operated with the International Electrotechnical Commission and with the National Research Council in preparing the standard. The new standard will interest power-plant designers, turbine designers, boiler designers, and all others working with problems involving the transfer and transmission of heat. It may be purchased for 20 cents per copy from the American Standards Association, 29, West 39th Street, New York City.

Voting Electrically

The Chamber of Deputies of the French Government recently passed a Bill authorising the installation in the Chamber of apparatus to permit members to record their votes electrically. The decision follows the satisfactory working of an experimental installation for 100 seats which was put into operation last autumn. In front of each member there will be four push-buttons by means of which he will be able to vote for or against, indicate that he wishes to abstain from voting, or rectify a vote already cast. The cost of the installation is estimated at about £5,000.

Congress of Radiology

The programme has been issued of the third International Congress of Radiology, which is to be held at the Sorbonne, Paris, from July 26th to 31st under the presidency of Dr. Antoine Béclère. Delegates from 26 countries are expected to be present and 300 papers are to be presented. They will be divided into the six following groups: diagnostics, Röntgen and Curietherapy, physics, biology, electrology, and natural and artificial sun-ray treatment.

Members of the I.E.E. (South Midland Centre) at Rugby

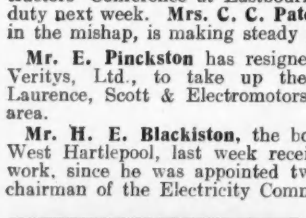
Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

We are glad to learn that **Mr. Ll. B. Atkinson** has now practically recovered from the injuries which he received in the motor accident which occurred during the Electrical Contractors' Conference at Eastbourne. He hopes to return to duty next week. **Mrs. C. C. Paterson,** who was also involved in the mishap, is making steady progress towards recovery.

Mr. E. Pinckston has resigned his position with Messrs. Veritys, Ltd., to take up the representation of Messrs. Laurence, Scott & Electromotors, Ltd., in the Birmingham area.

Mr. H. E. Blackiston, the borough electrical engineer of West Hartlepool, last week received a warm tribute to his work, since he was appointed twelve months ago, from the chairman of the Electricity Committee.

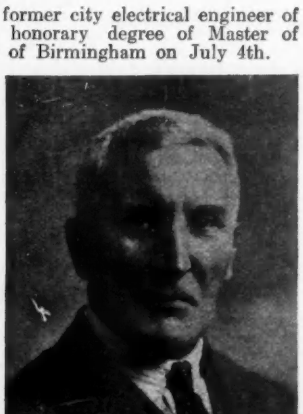


Mr. E. H. Shaughnessy, O.B.E., who has retired from the post of assistant engineer-in-chief of the G.P.O. *(Photograph by Elliott and Fry)*

Mr. E. H. Shaughnessy, O.B.E., retired from the position of assistant engineer-in-chief of the G.P.O. at the end of June. He joined the telegraph service as an operator in 1887 and became a sub-engineer in the Engineering Department nine years later. He rose through the various grades until, in 19.5, he was appointed assistant engineer-in-chief for the purpose of carrying out the Imperial wireless scheme. He had been engaged in radio work since 1913 and was expert witness for the Crown in the action brought by the Marconi Co. for breach of contract in 1915. During the war Mr. Shaughnessy evolved measures for the detection of illicit radio stations, and later organised and controlled direction-finding stations for following the movements of enemy aircraft. He was awarded the Order of the British Empire for these services. He has been a member of the Council of the I.E.E. for a number of years. Readers of the ELECTRICAL REVIEW are acquainted with Mr. Shaughnessy's splendid work in connection with Imperial radio communication, and will join us in wishing him many years of well-earned rest, although we cannot believe that so active a man will be content to remain unoccupied long. **Mr. A. B. Hart** succeeds Mr. Shaughnessy as assistant engineer-in-chief.

Mr. R. A. Chattock, the former city electrical engineer of Birmingham, received the honorary degree of Master of Science from the University of Birmingham on July 4th.

Commander Rollo Appleyard, O.B.E., whose "Tribute to Michael Faraday" is reviewed in this issue, has many other literary works to his credit, most of them of a scientific and technical character. He has also been responsible for a number of important inventions, such as the conductometer, an instrument for measuring electrical conductivity, and instruments for use in aerial navigation. His researches in dielectrics, alloys and other directions have produced results which have considerably assisted development. During the war he served with the R.N.V.R.; he was also adviser to the Air Service and War Office. He is a member of both the Institutions of Civil and Electrical Engineers.



Commander Rollo Appleyard, whose book on Faraday is reviewed on p. 54 *(Photograph by Lafayette)*

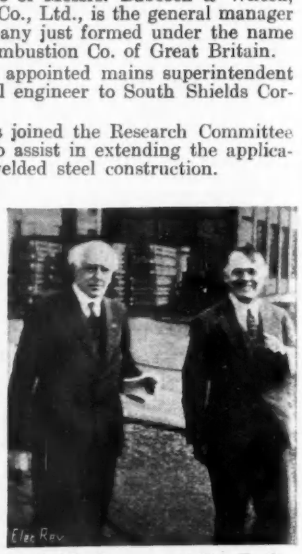
A number of staff changes have been announced by the India Rubber, Gutta Percha and Telegraph Works Co., Ltd. **Mr. T. A. Cullen** has been appointed manager of the Dublin branch, while the management of the company's Birmingham and Sheffield branches is now in the hands, respectively, of **Mr. Rossiter** and **Mr. H. J. Hodges. Mr. G. F. Wesson** has relinquished control of the Sheffield branch in order to take up an appointment as special representative in the home territories. **M. Selit Renny** has been appointed general manager for the company in Middle Europe, after having devoted many years to the interests of the company on the Continent, and **Mr. W. A. Cook** (London branch) is now acting as representative in the Portsmouth district.

Mr. Lowden Morton, late of Messrs. Babcock & Wilcox, Ltd., and the Vickers Boiler Co., Ltd., is the general manager and chief engineer of a company just formed under the name of the Illinois Stoker and Combustion Co. of Great Britain.

Mr. G. H. Dale has been appointed mains superintendent and deputy borough electrical engineer to South Shields Corporation.

Major James Caldwell has joined the Research Committee of the Quasi-Arc Co., Ltd., to assist in extending the application of electric welding to welded steel construction.

Professor W. Cramp, D.Sc., and **Mr. F. P. Whitaker** were among the 120 members of the I.E.E. (South Midland Centre), who, with the addition of a Rugby contingent which spent most of the day with the party, took part in the annual summer meeting held on July 2nd. Leaving Birmingham by coach in the morning, the party took lunch at Willenhall, Warwickshire, and afterwards visited the works of the B.T.-H. Co. at Rugby, where tea was taken by invitation of the company. Mr. H. N. Sporborg (director) welcomed the guests in a brief speech, to which Mr. G. Rogers (chairman, South Midland Centre) briefly replied. The evening was spent in visits to Jephson Gardens, Leamington; to Sherbourne Hill (near Warwick), at the invitation of Mr. P. Oliver, of the Midland Electric Light & Power Co., Ltd.; and to Stoneleigh Abbey Deer Park. Others present included Messrs. N. B. Rosher, J. Coxon, G. R. J. Parkinson, E. F. Hetherington, H. Hooper (hon. secretary), and R. H. Rawll (Asst. Hon. Secretary).



Prof. W. Cramp and Mr. F. P. Whitaker at Rugby

The honorary degree of Master of Arts was conferred by the Birmingham University on **Lady Brooks, O.B.E.,** on July 4th in recognition of her public service, and also for work in connection with the Electrical Association for Women and the Anglo-French Society.

Mr. T. J. Gray, electrical engineer to the Shipley U.D.C., is shortly retiring and the question of the appointment of a successor was discussed by the Council last week.

Correction.—In our issue of June 12th it was stated that Mr. W. Diamond is to continue as electrical engineer to the Mitcham Urban District Council. It is, of course, the Hitchin undertaking to which Mr. Diamond has been acting as engineer-in-charge and which is being taken over by the Council from the Electric Supply Corporation, Ltd.

Obituary

Mr. F. Crawford.—We reported in our last issue the death, on June 27th, of Mr. Fred Crawford, manager of the Liverpool branch of the General Electric Co., Ltd. Mr. Crawford was 56 years of age, and had been associated with the G.E.C. for 41 years. He spent 23 years in Manchester, during the latter part of which he was manager of the electric light supplies department; he was manager of the Liverpool branch for 18 years. The funeral took place, with Masonic honours, at Rake Lane Cemetery. It was attended by a number of his colleagues from the head office and branches of the G.E.C., and many representatives of the electrical industry.

Mr. W. E. Haley.—The death has occurred at the age of 63, following an illness of some seven weeks, of Mr. Walter Edwin Haley, assistant manager of the Shipley Urban District Council's electricity undertaking. Mr. Haley entered the service of the Department in 1915 as assistant engineer. He leaves a widow, a son and three daughters.

Dr. E. G. Acheson.—On Monday last Dr. Edward G. Acheson died in New York at the age of 75. Dr. Acheson joined Mr. T. A. Edison in 1880 and assisted him in the Paris International Exhibition and in a number of early Continental lighting installations. He was one of the discoverers of carborundum, and he also produced a pure synthetic graphite. He was a member of many American and foreign technical and scientific bodies.

Mr. S. F. Walker.—The death occurred at Bath on June 21st of Mr. Sydney Ferris Walker, M.I.E.E. Mr. Walker, who was in his eightieth year, commenced his career in the Navy, but he left the service on account of short sight and joined the staff of Lord Kelvin (then Sir William Thomson) at Woolwich. He was a contributor to the ELECTRICAL REVIEW over thirty years ago, his subjects ranging from electric motors to electrical installation work.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Roxster Co., Ltd.—Private company. Registered July 3rd. Capital, £3,000 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, dealers in electricity, &c. The directors are: E. Asseo (managing director), 11, Cunningham Place, Maida Vale, W., E. H. Jansen, A. Joyau and R. Joyau, addresses not stated. Secretary: H. Tracey. Solicitors: R. H. Behrend & Co., 17, Surrey Street, Strand, W.C.2.

Worlds Wireless, Ltd.—Private company. Registered July 3rd. Capital, £100 in 1s. shares. Objects: To carry on the business of electricians, manufacturers of and dealers in all kinds of goods in connection with sound and vision production, wireless, electrical and engineering trades and industries, &c. The directors are: E. F. R. Wood, 83, Herne Hill Road, S.E.24, W. R. Wood, 142, Court Lane, S.E.21, and A. E. De Gray, 60, Barrowgate Road, W.4. Solicitors: Thorp, Saunders & Thorp, 92, Victoria Street, S.W.1. Registered office: 3, Church Road, Croydon.

Betta Electric Motors, Ltd.—Private company. Registered June 30th. Capital, £500 in 450 ordinary and 50 founders' shares of £1 each. Objects: To acquire and exploit licences in respect of certain patents for inventions relating to motor mechanism for sound-producing machines, to adopt an agreement with Royal-motor A.G. (Switzerland), A. Boitel and Rose Morris-& Co., Ltd., and to carry on the business of manufacturers of and dealers in gramophones, amplifying and similar machines, radio and wireless instruments, &c. The subscribers are: Otto Ruhl, 50, Roxborough Park, Harrow; S. Rose, 126, Harrow View, Harrow; A. A. Junler, 111, Clifton Court, N.W.8; and A. Boitel, Sverder (Havel), Germany. A. Boitel is the first director. Secretary (pro tem.): J. Lecker. Registered office: 44, Bedford Row, W.C.1.

North London Valve & B.U.R.T.S., Ltd.—Private company. Registered June 29th. Capital, £2,000 in 7,600 7½ per cent. cumulative preference shares of 5s. each and 2,000 ordinary shares of 1s. each. Objects: To manufacture all kinds of wireless valves, electric lamps, X-ray and other electrical tubes, wireless telephonic, television and photographic apparatus, &c. The directors are: Capt. C. E. Thomas, "Parkfield," 125, Upper Clapton Road, E.5; R. H. Lewis, 161, Southbury Road, Enfield; F. A. Goulding and S. Game (addresses not stated). Capt. C. E. Thomas is permanent director and chairman. Solicitors: East and Deeks, Byron House, Finsbury Street, E.C.2.

Kent Dish Washing Machine Co., Ltd.—Private company. Registered July 2nd. Capital, £1,500 in 1s. shares. Objects: To acquire from C. F. Collins, "Dunorlan," Tunbridge Wells, the benefit of certain existing inventions relating to dish washing machines, &c. The directors are: C. F. Collins, "Dunorlan," Tunbridge Wells; A. H. Frater, 3, Garlinge Road, Southborough; and A. R. Cheale and A. J. Mitchell, both of 6, Church Road, Tunbridge Wells. Registered office: 3, The Priory, Church Road, Tunbridge Wells, Kent.

Lac Relays, Ltd.—Private company. Registered July 2nd. Capital, £1,000 in 500 10 per cent. cumulative preference shares of £1 each and 2,000 ordinary of 5s. each. Objects: To carry on the business of electrical, mechanical and general engineers and contractors, manufacturers of and dealers in radio instruments and accessories, wireless apparatus and components, &c. The directors are: H. P. Allison, Braeside, Deacons Hill, Oxhey, Herts.; F. C. George, 75, Lady Margaret Road, N., and J. D. Bateman, B.Sc. (Econ.), Oaklands, Fountain Road, Norwood, S.E.19. Registered office: 19, Southampton Buildings, Chancery Lane, W.C.2.

Lampall, Ltd.—Private company. Registered July 1st. Capital, £1,000 in £1 shares. Objects: To purchase and sell lamps and other electrical apparatus, &c. The directors are: S. H. Cary, 12, Tring Avenue, Ealing Common, W.5, and H. Pratt, Valhalla, Cromwell Road, Shenfield, Essex. Solicitor: H. C. Burgin, 12, Henrietta Street, Strand, W.C.2.

Returns of Electrical Companies

Electrical Agencies (London), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1930 (filed January 16th, 1931). All shares taken up. £1,000 paid. Mortgages and charges: £500.

M. Wooldridge (Wireless), Ltd.—Capital, £1,500 in £1 shares. Return dated December 31st, 1930 (filed May 15th, 1931). All shares taken up. £2 paid. £1,498 considered as paid. Mortgages and charges, nil.

Simmonds & Stokes, Ltd.—Capital, £15,000 in £1 shares. Return dated February 13th, 1931. 10,204 shares taken up. £1,725 paid. £8,479 considered as paid. Mortgages and charges: £3,700.

Modern Radio, Ltd.—Debenture dated June 18th, to secure £450, charged on the company's undertaking and property, present and future, including uncalled capital and goodwill, subject to prior debenture dated May 20th, 1931. Holder: B. A. Mahomet, 29, Gamble Hill, Bramley, Leeds.

Harris Williams (Servis), Ltd.—Satisfaction in full on June 22nd of debenture dated March 22nd, 1929, and registered April 5th, 1929, securing £2,250.

Associated Electricity & Monoxide Gas Corporation, Ltd.—Particulars filed of debentures not exceeding in the aggregate at any one time £20,000 authorised May 12th, 1931, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £400.

Rolyat Electrical Co., Ltd.—Satisfaction on June 24th of debenture dated April 18th, 1930, and registered April 29th, 1930. (According to the register of mortgages, the debenture registered April 29th, 1930, originally secured £1,000.)

C. A. Vandervell & Co., Ltd.—Satisfaction in full on April 22nd, of trust deed dated July 23rd, 1919, and supplemental trust deed dated August 18th, 1924, and registered August 1st, 1919, and August 19th, 1924, respectively, securing £300,000 debentures.

Electric Lamp Factors, Ltd.—Deposit on June 19th of deeds of 34-6, Topping Street, Blackpool, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Lancashire Electric Sign Construction Co., Ltd.—Particulars filed of debentures for sums not exceeding £500 at any one time authorised May 22nd, 1931, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £300.

Compania de Electricidad de la Provincia de Buenos Aires, Ltd.—Satisfaction in full on January 2nd, 1931, of trust deed dated November 24th, 1911, and registered November 29th, 1911, securing 45,000 bonds of £20 each. Notice filed June 26th, 1931.

City Notes

Whitehall Electric Investments, Ltd.

The annual meeting was held on July 2nd, the Hon. Clive Pearson (chairman) presiding. In presenting the report and accounts (ELEC. REV., July 3rd, p. 33), the chairman said the investments of the company and its subsidiaries had a total cost of £12,831,894, and their net assets were £13,360,000. Their investments in electrical undertakings, including their associated undertakings in Athens, in Spain, and in the West of England, amounting to £2,500,000, and their holding of preferred stock of American and Foreign Power Co., Inc., totalled £6,060,000. In regard to electrical companies in Devon and Somerset, the necessary Statutory Orders, with one minor exception, had now been obtained. The area covered embraced the towns of Bideford, Minehead, Wellington, Sidmouth, Exmouth, Dawlish, Teignmouth, and Paignton. Good progress had been made during the year in the change-over from d.c. to a.c., and considerable advance had been made towards the provision of supplies to rural areas and in the interconnection of the various companies. A bulk supply of electricity was now being taken from Exeter Corporation, approximately 60 miles of 33,000-V transmission line having been erected, together with 11,000-V secondary lines. A two-part tariff had been introduced and the hire and hire-purchase of electrical appliances and facilities for wiring premises on deferred terms were being made available so soon as the mains had been strengthened. The present income from these companies was small, but there were good prospects of a growing trade. Further capital would be required for the provision of additional plant at Athens, and a scheme had been prepared whereby their investment in this undertaking would be considerably increased. They had acquired during the year a substantial interest in the Fuerzas Motricés del Valle de Lecrin S.A., which operated in an extensive area in the South of Spain. This company was erecting a new hydro-electric plant of 14,000 h.p. to meet the increasing demand, and the plant would be ready for service early next year. The report and accounts were adopted.

The "Underground" Group

The railway companies in the London "Underground" group have maintained their interim dividends at last year's rates. These are as follows:—

Metropolitan District Railway Co.—Ordinary, 2½ per cent.

London Electric Railway Co.—Consolidated ordinary, 2½ per cent.

City and South London Railway Co.—Consolidated ordinary, 2½ per cent.

Central London Railway Co.—Undivided ordinary, 2½ per cent.; preferred ordinary, 2 per cent.

Underground Electric Railways Co. of London, Ltd.—Ordinary, 3 per cent.

A series of meetings of the stockholders in several of the companies in the group was held on July 1st with the object of assenting to the exchange of their present holdings for Transport Board stock. In the cases of the London and Suburban Traction Co. and the Central London Railway, resolutions were passed agreeing to the proposed exchanges, but in the cases of the meetings of the Metropolitan District Railway assented first preference stockholders and of the 6 per cent. first cumulative income debenture stockholders of the Underground Electric Railways of London, as there was not a quorum to pass the resolution, the meetings were adjourned. Replying to criticisms of the scheme, Lord Ashfield said that he thought it would work out all right. It was a very good offer, and it was certainly not going to be changed or improved upon. A meeting of the 5 per cent. first mortgage debenture stockholders of the Underground Electric Railways Co. of London, Ltd., on July 3rd, agreed to the exchange of their holdings for Transport Board stock.

Power Securities Corporation, Ltd.

The directors are offering to ordinary shareholders 300,000 £1 ordinary shares at 21s. each. It is proposed to issue them in the first instance in the proportion of three new shares for each five shares held at June 30th. Holders of both

classes of shares, preference and ordinary, may apply for any of the new ordinary shares not taken up. The new shares will rank *pari passu* with the existing ordinary shares, except that they will rank for dividend on the amounts paid, exclusive of premium, as from the date of allotment and the due date of subsequent instalments. In a circular issued to shareholders, the company states that it is providing funds for the construction of a hydro-electric undertaking pending its final financing on completion. This undertaking has contracted for the sale of its entire output at a rate which will provide revenue sufficient to cover adequately the annual service of the capital expended.

Anglo-Argentine Tramways Co., Ltd.

The accounts for 1930 show gross receipts of £4,324,836, and after deducting expenses, including £169,109 for renewals reserve, &c., and adding interest on investments, &c., there is a balance of £711,398. Out of this provision is made for debenture interest, &c., and after adding £91,475 brought forward, the total available is £186,786. Dividends on the first and second cumulative preference shares are paid and £7,286 is carried forward. The report records the retirement of Sir George Touche (chairman) from the board, and the election to the chair of the Duke of Atholl.

The accounts of the *Associated Telephone and Telegraph Co.* and its subsidiaries for 1930 show gross earnings of $15,200,356, as compared with $13,321,582 in 1929, and net earnings of $4,948,450, an increase of $261,263. In addition to the regular dividends on the first preferred and preference stocks and the class "A" stocks, two extra participating dividends of $1 each were paid on the latter, making a total dividend of $6 per share for the year. Dividends were also paid on the common stock during the year.

The report of *Petters, Ltd.*, for the year ended March 31st last shows a net profit of £35,335, and with the amount brought in, &c., a balance of £68,560. Reserve receives £10,000, and it is proposed to pay an ordinary dividend at the rate of 6 per cent. per annum, less tax, the carry forward being £45,016. The report states that important additions have been made to the range of the company's engine manufactures, from which it is hoped that, when trade improves, increased business will result. Meeting: July 14th.

The report of *Hall Telephone Accessories* (1928), *Ltd.*, covering the first half-year announces an interim dividend of 5 per cent. (same). The manufacture of telephone coin-collectors and stamp-vending machines has proceeded at a satisfactory rate, and the half-year has shown an increased inquiry for these products from overseas. The demand for the company's other types of machines has also been maintained.

The profit of *Aron Electricity Meter, Ltd.*, for the year ended March 31st last was £3,922, plus £82 brought in and £900 transferred from reserve. Interest at the rate of 6 per cent. on the income debenture stock absorbs £4,618, leaving £286 to be carried forward. The report states the demand for large meters, such as clock meters and kVA meters, has fallen off considerably. The new house meter was not ready for introduction until towards the end of the financial year, but is now meeting with considerable success.

The report of *Edmundson's Electricity Corporation, Ltd.*, for the year ended March 31st last shows a net profit of £220,281, as compared with £204,777 in the preceding year, to which is added £20,664, making £240,945 available. Reserve again receives £20,000, and the ordinary dividend is maintained at 7 per cent., the carry forward being £19,745. The book value of investments amounted at March 31st to £3,522,000, as compared with £2,858,000 in March, 1929. Meeting: July 14th.

The report of the *Kalgoorlie Electric Power and Lighting Corporation, Ltd.*, for 1930 shows a profit of £20,729, as compared with £18,392 in the preceding year, to which is added £1,468 brought in, making £22,197. After providing for income tax, depreciation, reserve, &c., it is proposed to pay a dividend of 6 per cent., less tax at 2s. 3d. on the ordinary shares, leaving £1,500 to be carried forward.

The directors of the *Bournemouth and Poole Electricity Supply Co., Ltd.*, have announced an interim dividend of 6 per cent. on the ordinary shares. They state that the Corporations of Bournemouth and Poole have decided to grant an extension of tenure for a period of 21 years in respect of the portion of the company's undertaking which could be purchased in 1932.

A final dividend of 3 per cent. has been declared by *Grosvenor Electric Batteries, Ltd.*, on the 6 per cent. redeemable preference shares.

An interim dividend of 5 per cent. actual, less tax, is announced by the *Chiswick Electric Supply Corporation, Ltd.* Last year's interim dividend, on a smaller capital, was 6 per cent.

The directors of *John Shaw & Sons, Wolverhampton, Ltd.*, report that, owing to adverse trade at home and in India, they are unable to recommend the payment of a final dividend on the 7 per cent. cumulative preference shares for the year ended June 30th.

Victoria Falls and Transvaal Power Co., Ltd.—The accounts for 1930 show a net profit of £381,417, as compared with £380,331 in the preceding year, to which is added £172,578 brought forward, making £553,994. Reserve receives £50,000, and the ordinary dividend is maintained at 15 per cent., the carry forward being increased to £194,463. The report records the retirement from the board of the Marquess of Winchester, and the election of Mr. A. E. Hadley as chairman. Mr. B. Price has been appointed a director. Meeting: July 23rd.

The report of *W. & T. Avery, Ltd.*, subject to audit, shows a net profit for the year ended March 31st last of £104,270, as compared with £122,173. A final ordinary dividend of 10 per cent. is recommended, making 15 per cent. for the year (same), leaving £56,268 to be carried forward (£59,035.)

The *East African Power and Lighting Co.* has declared a final dividend of 4 per cent. on the ordinary shares, making 7 per cent. for the year (same).

The *Notting Hill Electric Lighting Co., Ltd.*, has announced an interim dividend of 5s. per share, less tax, on the deferred shares (same).

The profits of *Belliss & Morcom, Ltd.*, to March 31st last amounted to £22,368 (against £23,259). A final dividend of 7½ per cent. is recommended on the ordinary shares, making 12½ per cent. for the year (same) and £301,270 is carried forward (£302,191).

The directors of the *Richmond (Surrey) Electric Light and Power Co., Ltd.*, have declared an interim dividend of 4 per cent., less tax, on the ordinary shares.

The report of the *British Columbia Electric Railway Co.* for the year ended June 30th, 1930, shows a total net profit of £520,255, as compared with £521,083 in the preceding year. To this was added £184,257 brought forward, making £704,512 available. Debenture interest absorbed £168,940 and preference and preferred ordinary dividend took £158,400. The deferred ordinary dividend was maintained at 8 per cent., leaving £184,683 to go to the next account.

The directors of the *Great Northern Telegraph Co.'s Holding Co., Ltd.*, propose to again distribute for the year ended June 30th last a total dividend of 20 per cent., to set aside £14,167 for taxes, and to carry forward £653.

Stocks and Shares

TUESDAY EVENING.

STOCK Exchange markets have been alternating between hopes and fears in regard to the implementing of the Hoover moratorium of war debts proposals. Expectations of failure chased those of agreement in a manner which has played upon the nerves of the markets, commodity, metal, and security, to an extent which has left the ordinary man in the street somewhat bewildered as to what the eventual outcome will be, and whether he will be right in adventuring money into purchase of stocks and shares with the hope of seeing trade improve. Quotations for the majority of stocks and shares given in our list are reasonably firm, without showing such special features as those which developed in each of the past two weeks. As illustrating the trend of speculative stocks, falls in Cables & Wireless issues may be mentioned. The shares in the manufacturing group hold the substantial gains that they secured during the latter half of June. With the somewhat grudging assent of France to the moratorium plan, Stock Exchange markets advanced, but did not succeed in retaining the whole of an earlier improvement.

Cheap Money

Each Thursday morning a considerable crowd of members now assembles at the bar of the Stock Exchange in order to await the announcement of the Bank Rate decision. Many people are looking for a reduction this week, because it is thought that the Bank of England Court has been waiting upon the decision of the French Government. This being definitely reached, the Bank Rate may be expected to drop to 2 per cent. British Government securities continue very hard, which serves to keep alive the constant anticipation of some plan being announced by the British Government for conversion of the 5 per cent. War Loan. City assumption is that Mr. Snowden intends to raise the financial credit of the country to a basis at which the return on British Government stock will be 4 per cent., and the course of prices during recent months has done a great deal to assist. When trade is slack, money becomes difficult to put to a profitable use. Accordingly, the Bank Rate comes down, as a reflection of the undue abundance of money that otherwise would be employed in trade. Central Electricity 4½ per cent. debenture is unchanged at 98½. London and Home Counties debenture went ex dividend last Thursday, and the price is now 98.

Stocks on Offer

About £5,000 London Power 5 per cent. redeemable debenture stock is on offer at 105¾, free of stamp and fee. The yield is £4 14s. 6d. per cent. on the money, and interest payments are due in April and October, but a sinking fund is now in operation for drawings annually at 100. Of the Tube Railway stocks guaranteed by His Majesty's Government, £1,000 Central London 4½ per cent. debenture, and £2,500 City & South London 4½ per cent. debenture, can be bought at 101¼, to give £4 8s. 6d. per cent. on the money. Interest payments

are due in January and July, and the stocks are both dated 1942-1972. A few day ago, £20,000 Metropolitan District 4 per cent. power house rent charge came on offer at 86. The return on this stock is £4 13s. per cent., and the security is eligible for trustees. Underground Electric Railways 5 per cent. first mortgage debenture, 1942-1963, May and November interest payments, can be bought at 102, to give £4 18s. per cent. on the money. This is not a trustee stock, but the security is well-margined.

Cables and Wireless

Reference has already been made to the weakness that developed in the stocks of the Cables & Wireless group. The 5 per cent. preference fell 2 points to 55½, and "A" ordinary were similarly lowered to 16, while the "B" fell to 10. It would appear as though holders of the preference stock were beginning to feel uneasy in regard to the payment of the dividend due in September next. As has been suggested here on a previous occasion, the apprehension of such a thing is likely to be brought forward each half-year when the time draws near for payment of this dividend. The report and accounts of the Merger for 1930 are expected to make their appearance on any day now. Marconi Marines went back 2s. to 35s. but recovered to 37s. Globe ordinary remain weak at 8½, on dividend apprehensions. The Associated Telephone and Telegraph Company of America, in its annual report, shows an increase of $1,878,000 in gross earnings, of which $261,000 was retained in net. American Telephone & Telegraph stock rose to 190 and International Telephones to 39, on the French acceptance of the Hoover plan.

Underground Electric Railways

Protests have arisen on the part of holders of some of the Underground stocks against the proportion of new securities to which they will become entitled under the scheme for exchange into London Passenger Transport stocks. Further meetings are to be held this month, and it is possible that more may be heard of the objections, particularly those on the part of holders of Underground 6 per cent. first mortgage income debentures. Some of the proprietors are very dissatisfied, claiming that their security stands to be lowered, in favour of the ordinary stockholders. The proprietors of the company's 5 per cent. first mortgage stock met last week to listen to Lord Ashfield's recommendations that the exchange shall be carried out, and they agreed to the resolutions which were placed before the meeting. In regard to the ordinary stocks, Underground Electrics are 6d. lower at 21s. 6d. No changes have occurred in Metropolitans or Districts. London and Suburban preference have hardened to 12s. British Electric Traction deferred stock is 75 points higher, at 975.

South Americans Better

Anglo-Argentine Tramways debenture stocks spurted sharply upon the issue of the report this week. The 5 per cent. debenture is 8 points higher at 30½. The 4 per cent. and 4½ per cent. debentures are both better at 54½ and 45½, respectively. Buenos Aires Lacroze debentures have rallied in sympathy. Brazilian Tractions have put on 3 points, at 25½, on Wall Street buying.

Electricity Supply

County of London ordinary shares at 46s. 3d. are 6d. better, and Metropolitans strengthened to 40s. bid. The group of London issues, apart from these gains, is practically unchanged. Amongst the provincial shares, Lancashire Light & Power rose 9d. to 22s. Electrical Distribution of Yorkshire new ordinary are better at 6s. 6d. premium. Northamptons advanced to 40s. 6d. Richmond (Surrey) rose to 2 1/16 on announcement of a 4 per cent. dividend, the same as that of a year ago. The Chiswick Electricity Supply has declared a 5 per cent. dividend on its increased capital. This time last year the dividend was 6 per cent. Bournemouth & Poole are better at 60s., upon maintenance of the 6 per cent. dividend. British Power and Light shares are marking time at 9s.

In the foreign list, Tokyo Electric 6 per cent. bonds are better at 91¾. Atlas ordinary shed a few pence, going back to 18s. 9d., the preference, however, keeping firm at 24s. 6d. Kalgoorlie Electric Power ordinary shares, of 10s. each, are firmer at 8s. The 1930 profits are rather better than those for 1929, and the dividend is again to be 6 per cent. Whitehall preference put on 1/16, with a rise to 25s. 3d.

Manufacturing and Equipment

British Aluminium ordinary, after a rise to 30s., reverted to 28s. 9d., thus retaining the advance of 3s. 9d. made in the preceding week. The manufacturing group as a whole is very steady. British Insulated rose to 57s. 6d., Henley's to 55s. 8d., and Callender's to 2¼. G.E.C. ordinary strengthened to 44s. 6d., and Associated Electrical Industries keep good at 21s. 3d.

Iron and steel shares are looking a more hopeful market in view of the settlement of the moratorium of war debts, but Babcock & Wilcox show a small loss at 47s. Vickers are somewhat on the dull side at 7s. 3d. The rubber share market has shown a little more resiliency, without there being, however, any particular change in the list of prices. The two leading gramophone companies have become amalgamated under the name of Electrical & Musical Industries, Ltd. Lively dealings are taking place in the £1 shares on the basis of 43s. Telegraph Manufacturing (1929) are a little harder at 2s. 4¼d., and Telephone Rentals at 3s. 7¼d. Philips Lamp Works, at 20s., are ex the recently-paid dividend.

Share List of Electrical Companies

	Nom.	Approx. Dividend 1929.	1930.	Price July 7 1931.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES	£					
Bournemouth and Poole	1	15	15	3	+1/8	5 0 0
Brompton Ordinary	1	8½	8½	28/6	—	4 18 3
Central Electricity 4½% Deb.	Stock	—	4½	97½	—	4 11 6
Charing Cross Ordinary	1	8½	8½	30/-	—	4 13 4
Chelsea	1	8¾	8¾	27/6	—	5 1 10
City of London	1	10	10	37/-	—	5 8 1
Clyde Valley	1	8	8	33/9	—	4 14 10
County of London	1	7	10	46/3	+6d.	4 6 6
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	12½	45/-	+1/8	4 17 9
Kensington Ordinary	1	8	8	30/-	—	4 13 4
Lancs. Light and Power	1	7	6½	22/-	+2½	5 18 2
London & Home Counties 4½% Deb.	Stock	—	—	98xd	—	4 12 0
London Electric	1	8½	9	34/-	—	5 5 11
Metropolitan	1	9	10	2	+9d.	5 0 0
Midland Counties	1	6½	7	27/6	—	5 1 10
Mid. Elec. Power	1	15	8	28/3	—	5 13 3
Newcastle-on-Tyne Ordinary	1	6	6	22/6	—	5 6 8
do. 7% Pref.	1	7	7	27/-	—	5 3 8
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref.	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall	1	8	8	29/-	—	4 16 7
Scottish Power	1	8	8	28/9	—	5 11 5
South London	1	8½	8½	27/6	—	5 1 10
Urban Ordinary	1	7	7	27/6	—	5 1 10
Westminster Ordinary	1	8½	8½	29/-	—	4 16 7
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/9	+1/8	5 16 6
Yorkshire Elec.	1	8	8	31/3	—	5 2 5
HOME RAILS						
Central London Ord. Assented	Stock	4	4	76	—	5 5 3
Metropolitan	,,	4	3½	48½	—	7 4 4
do. District	,,	5	5	64½	—	7 15 0
Underground Electric	£1	8		21/6	—6d.	7 8 10
TELEGRAPHS AND TELEPHONES						
Anglo-Am. Tel. Pref.	Stock	6	6	104½	—	5 14 10
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	12½	12½	32/6	—	7 13 10
Cables & Wireless 5½% Pref.	Stock	5½	5½	55½	—2	9 18 2
do. A 7½% Ord.	,,	Nil	—	16	—2	... ...
do. B Ord.	,,	Nil	—	10	—1	... ...
Globe Tel. and T. Ord.	10	10	8½	8⅜	—	*10 0 0
do. do. Pref.	10	6	6	9½	—	6 6 4
Great Northern Tel.	10	20	20	27	—	7 8 2
Marconi-Marine	1	15	15	37	—	8 3 2
Oriental Telephone Ord.	1	12	12	2⅝	—	*5 6 6
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	5	5½	—	12/6	—	... ...
do. do. 2nd Pref.	5	6	—	7/6	—	... ...
do. do. 5% Deb.	Stock	5	5	30½	+8	16 5 0
British Electric Traction Def. Ord.	,,	5	5	975	+75	... ...
do. do. Pref. Ord.	,,	8	8	124½xd	—1	6 8 9
Brazil Traction	100	8	—	25½	+3⅛	... ...
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	97½	—	5 2 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	12/-	+6d.	... ...
London United Tram Deb.	Stock	4	4	62½xd	—	6 8 0
Mexico Trams, 5% Bonds	—	5	5	43½	—	11 15 4
Mexican Light Common	100	Nil	Nil	46½	—	... ...
do. 7% Pref.	100	7	7	71½	—	9 15 10
do. 1st Bonds	—	5	5	75½	—	6 12 5
Victoria Falls Ord.	1	15	15	58/9	+6d.	5 2 2
Yorkshire (West Riding)		Nil	Nil	5/9	+3d.	... ...
MANUFACTURING COMPANIES						
Assoc. Elec. Ord.	1	6	6	21/3	—	5 13 0
do. Pref.	1	8	8	28/3	—	5 13 0
Babcock & Wilcox	1	15	14	47/-	—6d.	*5 19 2
British Aluminium Ord.	1	10	10	28/9	+1/8	6 18 4
British Insulated Ord.	1	15	15	2⅝	+⅛	5 4 4
Brush Ord.	Stock	10	5	60	—	8 5 0
Callenders	1	15	15	2⅝	—1/8	5 4 4
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	30	30	8	—	8 11 5
do. 8% Pref.	1	8	8	28/-	—	5 14 5
Edison-Swan 1st Pref.	1	7⅛	7⅛	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	99½	—	5 8 1
Electric Construction	1	5	Nil	11/3	—	... ...
Enfield Cable Ord.	1	25	25	4	—	6 5 0
English Electric	1	Nil	Nil	5/-	—	... ...
do. do. Pref.	1	Nil	Nil	5/-	—	... ...
Ferranti Pref.	1	7	7	20/6	—	6 16 7
G.E.C. Pref.	1	6½	6½	25/6	—	5 2 0
do. Ord.	1	14	10	44/6	+9d.	4 10 0
Henley	1	30	30	5⅜	+⅛	5 6 1
do. 4½% Pref.	5	4½	4½	4⅜	—	5 2 10
India-Rubber	1	Nil	Nil	4/6	—	... ...
Johnson & Phillips	1	10	10	28/9	—	6 19 2
Siemens Ord.	1	7½	7½	23/9	—	6 6 4
Telegraph Construction	12	10	7½	12½	—	7 3 10

*Dividends paid free of Income Tax.

The Situation of Dutch Industry and Trade

MR. R. V. LAMING, O.B.E., Commercial Secretary to the British Legation at The Hague, has forwarded his annual report on economic conditions in the Netherlands to the Department of Overseas Trade (Stationery Office, 4s. 6d. net).

In common with its neighbour Belgium, Holland was one of the last to feel the pressure of world economic conditions, but during the past year the effects have been very pronounced. "Agriculture, industry and finance have had a poor year, but, conversely, the coal-mines have had a record output and have obtained remunerative prices for it. The electricity supply industry also continued to advance, the output rising from 1,606 million kWh in 1929 to 1,818 millions in 1930.

Foreign trade, both inward and outward, increased in volume slightly, but values were considerably lower. Great Britain's share of the import trade decreased from 8.59 to 8.19 per cent., and at the same time exports to this country went from 10.80 to 11.04 per cent. of the total.

Electrical Trade

An analysis of the import trade shows that in 1930 the purchases of generators, dynamos, turbo-generators, &c., fell in volume from 6,851 tons to 2,653 tons. Nevertheless, the imports of British products of this class increased from 471 to 683 tons. Owing to the difficulties experienced by Dutch electrical manufacturers in foreign markets, they are being forced to seek openings in their own country; this has intensified competition in the home market. During 1930 Dutch exports of generators, &c., declined considerably—from 4,417 tons to 922 tons. Imports of British and Belgian radio sets, &c., are the only ones which have increased slightly, imports from elsewhere having fallen. Competition from home and foreign sources remains severe and requires careful watching. Although British supplies of electrical instruments were maintained at about 700 tons, there was a total increase of 1,800 tons to 8,855 tons, indicating that the market is still expanding. Imports of British cranes and other lifting machinery made an advance, and British compressors and pumps held their position better than those of competing countries. There was a rise of 3,800 tons, to 24,900 tons, in imports of insulated copper wire, but the British share remained negligible. Dutch exports of this wire declined from 8,200 tons to 8,000 tons. Incandescent lamp imports continued to progress, rising from 2,873,100 lamps in 1929 to 4,141,600 in 1930. France secured the largest share in this increase, but Great Britain's small quota declined substantially.

The Industrial Position

There has been a steady rise in unemployment in the Dutch metal industry. The engineering section has been badly hit, and its situation has been worsened by German competition. Referring to a locomotive contract, the report states that a German concern cut its price to an abnormally low figure. It is suggested that this could only have been done with an ulterior motive. It was apparently not due to a desire to obtain a footing in the market, "as electrification of the Dutch lines is being proceeded with, and the time will come when locomotives will be scrapped altogether."

It is said that manufacturers of electrical machinery, instruments and apparatus have had less to complain of, and both at home and abroad the market has continued to develop in a satisfactory manner. So far as machinery is concerned, this statement seems to be in discordance with the earlier mention of a fall in exports from 4,417 to 922 tons.

The radio and lamp industry had a less successful year. The number of employés was reduced and the total value of exports was reduced. These do not, however, always denote sales to the public, but also include consignments to subsidiary selling companies.

A census taken in 1929 showed that there were 36 factories in Holland producing electrical machinery, &c., and the value of their production rose from Fl.19,632,000 in 1928 to Fl.26,132,000 (florin=1s. 8d.). About a third of this was exported. About the same proportion of the incandescent lamps produced was shipped abroad; the total value of this production increased from Fl.18,082,000 to Fl.19,638,000.

Communications

A fall in the revenue from the telegraph service was balanced by the increased income from radio-telegraphy. The telephone business continued to expand. The length of wires in service increased from 385,619 to 433,154 km. Two thousand kilometres of telephone lines are to be renewed or laid, for which Fl.645,000 is estimated. Telephone cables are to be laid from Rotterdam to Utrecht and Zwolle, and from Eindhoven to Venlo, and a fourth submarine cable across the North Sea. These cables are estimated to cost about Fl.5 million. The cost of extending the telephone cables in local areas is estimated at Fl.1,615,000.

Specialist Electrical Works in Germany

DISCUSSING the situation of the German electrical industry, a Frankfort newspaper points out that apart from the two or three large manufacturing firms, an important rôle is played by the firms of medium size which are generally termed "special" works because they devote themselves principally to the production of particular classes of plant and apparatus. While some special firms have disappeared as independent undertakings in recent years, other and new firms have arisen in their place. With their financial strength the large firms have been able gradually to build up a comprehensive manufacturing programme. In this direction lies the difference between them and the special works which as a rule have only a limited scope. Moreover, while the large firms have their own branches which also carry out installation work, the special firms work with independent contractors. In addition the large firms have extensive branch networks abroad, which in many cases has been prompted by Customs barriers. On the other hand, the special works have to overcome these barriers to sell their products in foreign countries.

It is assumed that the great development of the German export trade in electrotechnical products is not due solely or principally to the activity of the large firms. Excluding deliveries on reparation account it is recalled that the exports in 1924 represented a value of 5,194.4 million marks; in 1927 the value was 7,723.5 million marks; in 1928, 8,700 millions; and in 1929, 9,037.5 millions. In 1930, however, the value declined to 9,037.5 million marks. For the four months ended with April in the present year the value of the exports amounted to 2,448.2 million marks as compared with 3,119 million marks in the corresponding period of last year.

It is considered that the special works are in no danger of losing their independence provided that they are correctly managed and if technical development does not cause a depreciation of their work and capital, while at the same time their competition exercises an important control over sale prices in the interest of public authorities and other customers.

The Canadian Electricity Supply Industry in 1929

THE preliminary report of the Canadian Department of Trade and Commerce on the central electricity station industry during 1929 states that the total output of all central stations was 17,962,515,000 kWh for the year under review, an increase of approximately 10 per cent. as compared with the previous year's figure.

At December 31st, 1929, the total capital investment in the industry stood at $1,055,731,531, which was by far the largest investment in any single manufacturing industry, the second being the paper and pulp industry with $644,733,806. The increase of $98,811,929 during the year did not include expenditure on plants under construction, but only expenditure on stations operating on December 31st, although some of such expenditure was for works necessary for future extensions. The large increase in the use of electricity for both power and lighting purposes and also the increasing use of off-peak power from water power plants have increased the quantity of useful power per unit of equipment capacity, so that in 1929 the ratio of output to maximum of rated capacity was 50 per cent., as against 42 per cent. in 1922. This is a high ratio for the industry as a whole and, to a considerable extent, was due to a few large systems having ratios of from 60 to 72 per cent. In computing this ratio, allowance was made for generators installed or removed during the year. In the United States, according to the last report, which was for 1927, this ratio was only 33 per cent., making no allowance for equipment in service only part of the year. The nature of the industries served accounts for this difference to some extent.

With regard to capital invested, Ontario still ranked first with $422,486,669, and Quebec second with $421,000,578. Ontario held first place owing to its large investments in distribution and transmission systems, the investments for generating plant only in Quebec being the highest at $298,564,636 (against $221,449,751 in Ontario). The total investment in Canada averaged $261 per kVA capacity of main plant. This average varied in the different provinces due to differences in transmission and distribution systems and in power plants. The investment in generating plant alone was lowest in Manitoba, averaging $69 per h.p., whereas in Ontario and Quebec there was very little difference, the averages being $135 and $133, respectively.

The total revenue amounted to $122,883,446, which did not include any payments for power interchanged between stations but only the revenue received from consumers and for power exported to the United States. Over one-quarter of the revenue, or $33,627,863, was received from domestic supplies.

In computing the average revenue per kWh for all purposes, the power generated in Quebec and transmitted to Ontario for consumption has been included in the computations for both provinces. Quebec stations showed the lowest

average of 0.47 cent, the large quantities of power sold to pulp and paper mills and to other such customers being responsible to a large extent for this low average. The average revenues in the other provinces were: Manitoba, 0.58 cent; Ontario, 0.76 cent; British Columbia, 0.88 cent; New Brunswick, 1.76 cents; Alberta, 2.14 cents; Nova Scotia, 2.87 cents; Saskatchewan, 3.49 cents; and Prince Edward Island, 7.45 cents.

The total number of consumers amounted to 1,555,883. British Columbia possessed the largest number of domestic service customers per 100 of population with 22, Ontario was second with 17, Quebec third with 14, and Manitoba fourth with 11. Using the 1921 census figure of 4.97 persons per dwelling it is estimated that an average of 66 per cent. of all urban and rural dwellings in Canada use electricity.

Transmission pole line mileage increased during the year from 14,372 to 17,069 miles, and main and auxiliary plants had a total rated capacity of 5,097,443 h.p., an increase during the year of 310,543 h.p.; the increase in dynamo capacity was 294,499 kVA. The water wheels and turbines had a total rated capacity of 4,718,927 h.p., an increase of 273,396 h.p., representing 96 per cent. of the total power in main plant.

Of the 17,962,515,000 kWh generated, 21 large organisations produced over 93 per cent. and four of these produced 64 per cent., the largest being the Hydro-Electric Power Commission of Ontario, which generated over 24 per cent. of the total and also purchased 3.6 per cent. from other stations. These ratios show to what extent the central electricity station industry in Canada is being controlled by a few large organisations. Of the total production, 1,490,645,953 kWh was exported.

The total cost of fuel was $3,015,895 for a total production of 358,711,000 kWh, or an average of 0.84 cent per kWh. Over two-thirds of the total bill was for coal and 25 per cent. for fuel oil.

New Zealand as Producer and Importer

THE fourth of a series of useful surveys of the manufacturing industries of Empire countries by Mr. H. N. Carvalho, has been published by Erlangers, Ltd. (price 2s. 6d.). This deals with New Zealand and contains a great deal of information of commercial value.

Although New Zealand has a population of less than 1½ millions it has reached a state of development as high as that of any country in the world, and, being mainly agricultural and pastoral, it forms an important market for industrial products.

That is not to say that the Dominion itself is not an industrial producer. In 1928-29 there were 5,136 manufacturing establishments of various kinds with a total gross production of £93,172,000, but of this industries in the "food, drink and tobacco" group accounted for £50,604,000. The number of "metal, metal working and machinery" establishments was 584 and their total gross production £5,215,916. "Heat, light and power" embraced 152 establishments and had a gross production valued at £6,970,000. In New Zealand at least half of the manufacturing industries are the mainstay of the primary industries, and although the policy of recent Governments has been to endeavour to stimulate new local manufactures by protective tariffs, in most instances the results have been insignificant.

The Engineering Industry and Imports

General engineering was carried on in 205 factories during 1928-29 and the gross value of production (£2,006,000) represented about 40 per cent. of the total for the whole of the metal and metal-working group. The electrical engineering industry, which is shown separately, comprised 30 establishments, employing 3,741 people, its gross output being valued at £133,000.

The dependence of New Zealand upon overseas suppliers for the bulk of her requirements of this class is evident from the fact that against the total home production of £5,216,000, imports of manufactured goods in this category in 1929 were valued at about £10,000,000. Of these imports, electrical machinery and apparatus had a value of over £2,000,000.

Electric Light and Power

Dealing with the various stages of the Dominion's industrial development, the report refers to the rise of steam and oil as the accessories of light, heat and power and says "electricity came along and swept that phase away." In the "Heat, light and power" section of the report this predominance of electricity is made clear. Whereas in 1928-29 there were only 46 undertakings making and supplying gas, their gross output being valued at £1,531,000, there were 93 electricity supply undertakings with a gross output of the value of £3,833,000. In addition to this there were 10 tramway undertakings whose gross production was put at £1,607,000.

The rapid electrical advance has been due to the State development of the Dominion's water power; at March 21st, 1930, the hydro-electric power harnessed totalled 260,434 h.p., against 157,418 h.p. in 1929 and 52,244 h.p. in 1923. Some particulars of the various Government hydro-electric undertakings are given and it is mentioned that the total expenditure stood at over £10,000,000 on March 31st, 1930. In 1929-30 the maximum load was 109,520 kW, as compared with 39,790 kW in 1925-26, and the total sale of energy about 445 million kWh, against 166 millions.

In addition to the Government schemes about 35,000 kW of generating plant is operated by public and private suppliers, and of 37 stations 31 are hydro-electric.

Electrical Imports

The Dominion is dependent on imports for practically all her electrical machinery and apparatus, a small quantity of insulators are manufactured and a few appliances for telegraphy and telephony. The only trade of any importance is in electric cooking apparatus.

In the last year for which complete details are available, 1928-29, the total value of electrical apparatus imports was £2,089,824 and the shares of the supplying countries were as follows:—Great Britain, 55.2 per cent.; United States, 23.8 per cent.; Canada, 9 per cent.; Holland, 2.3 per cent.; Australia, 2 per cent.; and Sweden and Germany, under 2 per cent. The principal item in this section was generators, motors and transformers (£422,705), of which Great Britain accounted for about 64 per cent. Next in order were cables (£366,082) of which all but a small quantity were supplied by this country. Canada was the principal supplier of electrical cooking apparatus (£62,766 out of a total of £70,332) and the United States led in the imports of batteries and cells, lamps n.e.i., telegraph and telephone apparatus and radio sets.

In the year ended March 31st, 1930, electrical imports rose to £2,183,324 but the United Kingdom's quota showed a small decline, while the share of the United States advanced. The preference accorded to British products is considerable.

Italian Electrical Trade

WE published a summary of the figures relating to Italian foreign electrical trade during 1930 in our issue of April 17th (p. 670). This showed that both imports and exports decreased—the former from £3,829,335 to £3,639,765 and the latter from £955,130 to £919,485.

Further information now to hand shows that the large increase in the imports of radio apparatus was greater than the increase in value indicated; while the value rose by 16 per cent., the volume was over 70 per cent. greater. There was a substantial rise of both volume and value in the case of motors and generators. Great Britain increased her share of this trade, as did Germany and Sweden, but the imports from France, Hungary, and the United States showed a decline. The volume and value of unspecified apparatus decreased considerably, Great Britain's quota being somewhat reduced; on the other hand, Germany, the largest supplier, secured a greater proportion of the trade. Electric furnace carbon imports were much lower, the countries most affected being Germany, the United States, and Jugo-Slavia. The continued fall in imports of incandescent lamps is attributable to the growing Italian production. In 1929 the decline in volume amounted to 24 per cent.; last year it was nearly 30 per cent.

The leading item in the Italian export list is motors and generators, which were rather smaller in value last year than in 1929. The principal customers for this class of equipment were Argentina, Brazil, and British India. In exports of Italian cable there was a very considerable decrease last year—80 per cent. in value and 43 per cent. in volume—due entirely to the smaller purchases by Argentina, which is Italy's leading market for cables.

Electrical Plant in Jamaica

IN the returns of Jamaica's imports last year there is an unusually large item from the United Kingdom under the heading of electric lighting and power machinery, duty free, namely £14,382. This brought the home country to the head of the list of electrical suppliers, a place usually occupied by the United States. The item included a large generating unit for Kingston ordered by the Canadian-owned Jamaica Public Service Company, which is the only buyer of any importance of such plant. Specially favourable treatment is accorded to this company by the Customs when it needs to import machinery or equipment in constructing new works or renewing existing works, the rate of import duty being only 5 per cent. for Empire manufactures, whereas the rate of electrical apparatus and machinery generally is 15 per cent. *ad valorem* under the preferential tariff and 20 per cent. *ad valorem* under the general tariff. The import returns also show a big increase in wireless apparatus, and in telegraph and telephone equipment, the last-named due to the installation of automatic telephones in St. Andrew's district.

Mr. F. W. Fraser, the Canadian Trade Commissioner, in reporting recently on the Jamaican market for electrical goods, ascribed last year's substantial increase in the consumption of electricity partly to the growth of the suburbs of Kingston and St. Andrew, and partly to pumping for irrigation.

Telephonic installations are thought likely to increase, as at present Kingston is not connected with the rest of the island. The Jamaica Telephone Company is an importer and the United Fruit Company owns over 400 miles of lines linking its plantations. Of other electrical appliances the Public Service Co. is the principal purchaser. There seems to be a good prospective demand for domestic electrical appliances.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Hire-purchase

The letter in your last issue from Mr. Jarvie of the United Dominions Trust, Ltd., is likely to create an entirely wrong impression. It will be gathered from the letter that electrical contractors are either very slow or perhaps completely indifferent to progress if they have not taken advantage of the hire-purchase facilities offered to them, but it is only by knowing both sides that the present difficulties and objections can be overcome so that some real progress can be made. I am an enthusiast for hire-purchase and, therefore, my remarks may be taken as an endeavour to be of some assistance.

Those financial houses who specialise in h.p. finance send out attractive circulars and use other methods of publicity which make the contractor sufficiently keen to make an inquiry either direct to the advertisers or to a business friend. If he does the latter it is likely to end there. But if he writes direct, then more interesting details are sent and the result is that he will most likely there and then inform the financial house that he proposes to adopt one of its schemes. Now begins the unfolding of further matters which makes the scheme less and less attractive.

The inquirer is first told in a very polite and courteous manner that it is usual to have a certified balance sheet submitted. He may or may not comply, but if he does and has had the misfortune to have encountered one or two moderately bad years, a further nice letter is sent, making no reference to the poor balance sheet, but asking for personal guarantees and these must obviously be of a sufficiently substantial character.

The electrical contractor has to indemnify the financial house against any possible loss on any agreement. Now is this quite fair? No doubt sheaves of argument can be produced in favour of it, but that will get us nowhere, nor will it make a success of the scheme. A clearer understanding of our difficulties as they really are could no doubt produce a better working arrangement which would unquestionably add many thousands of pounds to the turnover of the electrical industry.

Some manufacturers have their own hire-purchase schemes which the electrical contractor can use. These are of some benefit but they only make possible a small fraction of the business really available. The supply authorities do undoubtedly have an advantage because of the very long period of credit (often three or five years) over which the payments are spread. To the best of my knowledge no financial house would allow any contractor to offer such terms.

Before much progress can be made the financial houses must be prepared to take much more risk just as the supply companies and the manufacturers do. The contractors in these instances are never required to guarantee payment if the hirer defaults, they are not required to submit a balance sheet or to give or obtain personal guarantees.

I believe that the E.C.A. has endeavoured to find a basis for a workable and acceptable scheme with a few of the larger of these firms, but so far without success. It is not difficult to imagine why, if one side insists on every possible cover and plays for safety at every turn, and in addition wants a fairly high rate of interest.

If the contractor, the supply company, or the manufacturer insisted on such guarantees from the hirers as these financial houses do from the contractor, there would be no hire-purchase within the electrical industry at all.

Mr. Jarvie's concluding paragraph puts the blame on the contractor for not using the "facilities" available. I suggest that these facilities are like a golf course would be, where the green can only be approached through so many bunkers and difficulties that the average person is thoroughly afraid (and perhaps justly so) and where only the scratch players have a decent chance. Let him make a course more acceptable to the average player.

July 6th, 1931. INTERESTED.

Electrical Quotations

The contributor of the article in your last issue is obviously the perfect inquirer, who knows what he wants and how to ask for it. How often do we meet his opposite who only thinks he knows, but is unwilling to ask for advice, or who may know but does not state his requirements explicitly?

It is the multitude of such inquiries that has taught manufacturers the necessity of quoting separately for each item and although your correspondent prefers the "lump sum" quotation, there are many cases where such a practice would result in the whole tender having to be revised so as to exclude pulleys, rails, or starters. The tabular method of setting out a quotation is largely used by modern firms where a number of items are exactly similar, but it takes time for a typist to set out a table with proper spacing between the headings of the columns, and is not always the quickest method or the easiest to read when finished.

Your correspondent complains of being "harassed" by negligent salesmen, but even salesmen have their worries. What would he think of the buyer who tells his office boy to ring up Blank's Motors and get the price of a 5-h.p. a.c. motor, each separate inquiry from the salesman for further information as to speed, voltage, phases, frequency, type of motor, class of enclosure, size of pulley, torque required at starting, nature of startor, and number of trips being greeted with "Just a moment, please," and a wait of three or four minutes?

HIGGS MOTORS,
A. W. Fisher,
London, W.C.2, *July 6th*, 1931. *London Manager.*

Switchboard Attendants

Those of us who have had experience of switchboard work will appreciate Mr. C. Cuthbertson's article in your last issue on the suitability of candidates for switchboard operation. With the large stations of the grid every care will have to be taken in switching and synchronising, as a fault under such conditions would mean a heavy expense. Whilst the article mentions the need of practical experience with machinery under adverse conditions, a sinister factor which is overshadowing the electrical profession was missed, and serious "shut-downs" in certain selected stations during the last twelve months should act as a warning to selection committees that influence of any sort should never be given preference to practical experience.

Cardiff, *July 4th*, 1931. B. A. CRONIN, A.M.I.E.E.

Parliamentary Notes

[By our Special Parliamentary Reporter]

Railway Electrification

On July 18th MR. DAY asked the Minister of Transport whether he had received any communication from the railway companies relating to the electrification of main-line railways; and if he could give particulars and state what his reply had been.

MR. MORRISON said that within the last few days he had received a communication from the Railway Companies' Association with regard to this matter but he was not yet in a position to make any statement.

London Electricity Tariffs

On July 1st MR. WEST asked the Minister of Transport how many different types of electricity tariffs for lighting and domestic purposes were in operation in the London area; and whether any action was being taken to bring about greater uniformity in this connection.

MR. MORRISON said that in the area of the London and Home Counties Joint Electricity Authority there were at least twenty different types of electricity tariffs or methods of charging for lighting and domestic supplies and within each of these methods there were many variations. He understood that the Joint Authority was engaged in exploring the possibility of reducing the number of variations in the basis of charge for domestic purposes but up to the present was unable to report any measure of success.

Electricity Supply in Gloucestershire

On July 1st MR. PERKINS asked the Minister of Transport whether he was aware that the towns of Minchinhampton, Chalford, and Brimscombe were not yet supplied with electricity; and whether he would urge the Electricity Commissioners to press the West Gloucester Power Co. to supply these towns as soon as possible.

MR. MORRISON said that the Electricity Commissioners had informed him that they were making inquiries into the matter.

Official Opening of Kirkstall Power Station

The official opening of the new Kirkstall power station of the Leeds Corporation, which was fully described in the ELECTRICAL REVIEW of March 27th last, p. 539, took place on July 6th, when the ceremony was performed by the Earl of Harewood in the presence of a large gathering, representative of all sections of the electrical industry, including Sir Andrew Duncan, chairman of the Central Electricity Board; Sir Archibald Page, chief engineer, C.E.B.; Sir John Brooke, Electricity Commissioner; and Mr. S. E. Fedden, engineer, Mid-East Area, C.E.B.; and Mr. C. N. Hefford, M.Sc., city electrical engineer, Leeds, who has been responsible for the design and specification of the works. Sir Andrew congratulated the Leeds Electricity Committee on the magnificent station it had established and which was to be the base-load station under the Mid-East England scheme of the Board.

At the celebration luncheon following the opening, Lord Harewood described the new works as a factor of vital importance in helping to cleanse the polluted atmosphere.

The Lord Mayor of Leeds, Dr. A. Hawkyard, said he was amply satisfied that the development of electricity supply would do much to mitigate the smoke nuisance and benefit the public health.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1929.

37,665. "Wave-filter circuits." W. Cauer. December 7th, 1928. (350,498.)

37,752. "Electric circuit-breakers." W. B. Whitney, E. B. Wedmore, and British Electrical & Allied Industries Research Association. December 9th, 1929. (350,418.)

38,099. "Electric relays." H. J. J. De Bellescize. December 12th, 1928. (350,487.)

38,620. "Electric relays for switch control." G. F. Burwood. March 18th, 1930. (350,582.)

1930.

532. "Power systems more particularly for marine propulsion." J. W. Davison, G. W. Higgs-Walker, E. M. Johnson and Associated Electrical Industries, Ltd. January 6th, 1930. (350,488.)

3,522. "Electrical measuring instruments." Ferranti, Ltd., and E. H. W. Banner. February 1st, 1930. (350,380.)

3,820. "Electric synchronised motors operated through an amplifying electric valve." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. February 25th, 1929. (350,506.)

4,358. "Printing-telegraph exchange systems." Siemens and Halske Akt.-Ges. November 19th, 1929. (Addition to 342,479.) (350,508.)

5,015. "Television or the like receiving apparatus." E. L. Gardiner and R. G. Wilson. February 14th, 1930. (350,512.)

5,021. "Valve amplifying apparatus." P. R. Coursey. February 14th, 1930. (350,513.)

6,947. "Electrical burglar alarm apparatus." E. Lewin. March 3rd, 1930. (350,519.)

7,089. "Methods of manufacturing electric insulating material." International General Electric Co., Inc. March 4th, 1929. (350,429.)

7,133. "Electric discharge tubes." Edison Swan Electric Co., Ltd. March 4th, 1929. (350,471.)

7.141. "Electric brushes." E. M. Wildey. March 5th, 1930. (Cognate application 34,857/30.) (350,386.)

7,216. "Electric transformers." British Thomson-Houston Co., Ltd. March 5th, 1929. (350,520.)

7,387. "Electric controlling devices." A. F. H. Briscoe. March 6th, 1930. (350,492.)

7,392. "Electric furnaces." British Hartford-Fairmont Syndicate, Ltd., and E. Meigh. March 6th, 1930. (350,474.)

7,409. "Electric furnaces." British Hartford-Fairmont Syndicate, Ltd., and E. Meigh. March 6th, 1930. (350,476.)

7,548. "Synchronisation devices for television, telephotography, and like purposes." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. June 27th, 1929. (Addition to 345,964.) (350,443.)

7,750. "Electrical switches or circuit-breakers." G. E. Whitehead and Whitehead's Electrical Inventions, Ltd. March 10th, 1930. (350,529.)

7,788. "Electrical image-translating systems." Electrical Research Products, Inc. April 30th, 1929. (Addition to 12,075/29.) (350,454.)

7,789. "Television." Electrical Research Products, Inc. April 30th, 1929. (Addition to 332,284.) (350,455.)

8,032. "Tape recording apparatus for electrical signalling systems." Standard Telephones & Cables, Ltd., and L. H. Webb. March 12th, 1930. (350,537.)

8,141. "Advertising and like signs." A. H. Brackensey and Franco-British Electrical Co., Ltd. March 13th, 1930. (Addition to 277,545.) (350,542.)

8,186. "Cathodes of vacuum electric-tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. March 13th, 1930. (350,545.)

8,277. "Step-by-step rotation by electric motors." International General Electric Co., Inc. March 14th, 1929. (350,553.)

8,452. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. Gillings and R. Taylor. March 15th, 1930. (350,576.)

8,698. "Means for converting the frequency of electric oscillations." Telefonaktiebolaget L. M. Ericsson. March 21st, 1929. (350,593.)

8,723. "Electromagnetic relays." Telefonaktiebolaget L. M. Ericsson. March 25th, 1929. (350,594.)

9,133. "Electric switches for signalling systems." B. L. Bobroff. July 31st, 1929. (350,604.)

9,167. "Electronic discharge apparatus." La Radiotechnique. April 9th, 1929. (350,605.)

9,458. "Electrically-heated utensils." Premier Electric Heaters, Ltd., and A. E. Newton. March 25th, 1930. (350,611.)

9,709. "Snap-action electric switches." C. L. Arnold and M.K. Electric, Ltd. March 26th, 1930. (350,615.)

9,936. "Electrical heating systems." S. A. Williams, J. L. Musgrave and R. Crittall & Co., Ltd. March 28th, 1930. (350,616.)

10,626. "Thermionic valve circuits." Gramophone Co., Ltd., and W. F. Tedham. April 3rd, 1930. (350,630.)

11,024. "Manufacture of electric incandescent lamps and the like." General Electric Co., Ltd. April 6th, 1929. (Addition to 337,301.) (350,635.)

11,113. "Automatic valves for pneumatic brake systems." Electro-Mechanical Brake Co., Ltd., and S. Smith. April 8th, 1930. (350,638.)

11,232. "Electric heating elements." F. A. Ross. April 9th, 1930. (350,640.)

11,460. "Wall boxes for electric switches and plugs." M. J. Railing and M. Levenger. April 10th, 1930. (350,647.)

12,082. "Flywheel lighting dynamos for motor-cycles." J. S. Rasmussen. April 29th, 1929. (350,654.)

12,795. "Electric relays." Siemens Bros. & Co., Ltd., and H. E. Humphries. April 25th, 1930. (350,663.)

13,206. "Electrically-operated reciprocating pumps." Tecalemit, Ltd. April 29th, 1929. (350,667.)

13,460. "Electrical measuring instruments." Evershed and Vignoles, Ltd., G. B. Rolfe and C. E. Perry. May 1st, 1930. (350,669.)

14,178. "Method and means for voltage regulation in alternating-current supplies." R. I. Bagnall and Foster Engineering Co., Ltd. May 8th, 1930. (350,674.)

14,179. "Electrical pick-ups for gramophones and the like." W. C. Bailey and W. C. Webb. May 8th, 1930. (350,675.)

14,189. "Rotatable disk elements of electricity meters." Aron Electricity Meter, Ltd., E. W. Hill, A. White and E. J. Riordan. May 8th, 1930. (350,676.)

17,289. "Electric circuit-interrupting apparatus or switches." Associated Electrical Industries, Ltd. June 3rd, 1929. (350,713.)

17,318. "Electric cables." Callender's Cable & Construction Co., Ltd., and J. F. Watson. June 4th, 1930. (350,714.)

17,329. "Ohmmeters." Evershed & Vignoles, Ltd., and G. B. Rolfe. June 4th, 1930. (350,715.)

18,188. "Voltage-measuring instruments." Associated Electrical Industries, Ltd. June 13th, 1929. (350,723.)

19,013. "Cover plates of electric lead accumulators." Britannia Batteries, Ltd. July 27th, 1929. (350,737.)

19,236. "Electrical insulating systems." M. L. Sindeband and P. Sporn. June 24th, 1930. (350,743.)

19,467. "Electric relay arrangement for the sequential control of electromagnetic switches and for other purposes." Siemens-Schuckertwerke Akt.-Ges. June 29th, 1929. (350,745.)

19,598. "Spinning-machines with individually electrically-driven flyers." L. Mellersh-Jackson. (Siemens-Schuckertwerke Akt.-Ges.) June 27th, 1930. (350,747.)

19,929. "Protective cut-out devices for electrical installations." P. Berger. July 1st, 1930. (350,751.)

21,763. "Switchgear devices associated with distribution cables." Felten & Guilleaume Carlswerke Akt.-Ges. August 28th, 1929. (350,779.)

22,303. "Apparatus for the measurement of capacitance and power factor of electrical condensers." A. Campbell. July 24th, 1930. (Addition to 317,642.) (350,789.)

22,472. "Electric liquid-level indicator for fuel containers." J. Konieczny. July 25th, 1930. (350,791.)

22,793. "Casing for time switches." Landis & Gyr Soc. Anon. July 21st, 1929. (350,794.)

23,915. "Base plate with interchangeable terminal block for electricity meters." Landis & Gyr Soc. Anon. September 2nd, 1929. (350,803.)

25,036. "Synchronising systems." Marconi's Wireless Telegraph Co., Ltd. September 21st, 1929. (350,813.)

25,450. "Apparatus for use in electrical measurements." G. R. Shepherd (Westinghouse Electric & Manufacturing Co.). August 26th, 1930. (350,819.)

25,830. "Device for testing electric lines and apparatus." W. Stejskal and A. Bulicke. August 29th, 1930. (350,823.)

27,682. "Electric transformers." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 18th, 1929. (350,845.)

28,766. "Electricity meters." Soc. des Compteurs de Geneve. December 10th, 1929. (350,853.)

29,632. "Wireless transmitting installations." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 9th, 1929. (350,857.)

1931.

14,775. "Electric circuit-breakers." A. Reyrolle & Co., Ltd., and J. Mirrey. March 11th, 1930. (Divided application on 7,956/30.) (350,483.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned:—

June 24th.

Blue Spot 66R (two different designs with similar lettering). Nos. 516,893 and 516,894. Class 8. Loud speaker units and gramophone pick-ups.—British Blue Spot Co., Ltd., 94-96, Rosoman Street, E.C.1.

Alba (lettering and design). No. 521,162. Class 8. Wireless telephonic and telegraphic apparatus and parts thereof.—A. J. Balcombe, 52-58, Tabernacle Street, E.C.2.

Harco. No. 521,404. Class 8. Electric batteries (not for medical purposes), radio-receiving sets and parts thereof.—Hardman & Co., Ltd., Yorkshire Street, Rochdale, Lancs.

Vario Chromatic. No. 521,466. Class 8. Radio-receiving sets, sound reproducers, thermionic amplifiers, &c.—Gambrell Bros., Ltd., 307, Merton Road, Southfields, S.W.18.

Liminode. No. 521,725. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Butler's Radio Service, 219, Forest Road, Walthamstow, E.17.

Nova. No. 522,881. Class 8. Apparatus for radio-telephony.—Aronwerke Elektricitäts Gesellschaft, Berlin. (British representative, Henry Fairbrother, 30-32,: Ludgate Hill, E.C.4.)

Ceit (lettering and design). No. 522,876. Class 13. Electric lamps (ordinary).—Société des Lampes et Entreprises Electriques, Ninove, Belgium. (British representatives: Cope & Co., 65, Victoria Street, Westminster, S.W.1.)

Pierrite. No. 520,950. Class 59. Electrical insulating material made of asbestos cement.—Société Eternit, Capelle-au-Bois, Belgium. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Beetle. No. 522,814. Class 50. Moulding compositions.—Beetle Products Co., Ltd., Oldbury, Birmingham.

July 1st.

Edison, Thomas A. Edison (lettering and design). No. 485,755. Class 8. Electrical storage batteries (not for medical purposes).—Edison Storage Battery Co., West Orange, N.J. (British representatives: Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Thyratron. No. 520,444. Class 8. Electric discharge tubes (not for medical purposes).—British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.

Brunswick Radio Valves (lettering and design). No. 522,291. Class 8. Thermionic valves.—Warner-Brunswick, Ltd., 13-14, Newman Street, W.1.

Ostar. No. 520,101. Class 13. Electric incandescent lamps (ordinary).—Gustav Ganz & Co., Vienna. (British representatives: Lloyd Wise & Co., 10, New Court, Lincoln's Inn, W.C.2.)

Kensun, No. 521,829, and Kenray, No. 521,830. Class 18. Electric and gas fires.—Archibald Kenrick & Sons, Ltd., Houghton Street, West Bromwich.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Airdrie.—Reconstruction of Alexandra Public School (£12,000); master of works, County Council, Hamilton.

Anglesey.—School, Amlwch (£20,000); director of education, Anglesey Education Authority.

Ashford (KENT).—Houses (30) for West Ashford R.D.C.; W. H. Carter, clerk, 17, Bank Street.

Barnsley.—Elementary school, Honeywell Lane, for E.C. (£35,157); W. Dunk & Sons, builders, Peel Street.

Berwick-on-Tweed.—Housing scheme, Magdalene Fields, for the T.C.; surveyor.

Bilston (WOLVERHAMPTON).—Houses (30) for the U.D.C.; Mr. Greensill, builder.

Birmingham.—Headquarters for the Municipal Bank (£75,000); T. C. Hewitt, architect, Exchange Buildings, East Nottingham. Modernisation of Western House Institution (£46,700); city architect. Schools, Weoley estate (£25,000), Warstock Lane, Billesley, and West Heath Road, Northfleet; chief education officer. Remodelling, City Road School (£5,500), for the E.C.

Blackpool.—Extensions, Layton Junior Council School, for the Corporation (£12,584); Atherton Brothers (Blackpool), Ltd., builders, Peter Street.

Bolton.—School for St. Ethelbert's, Deane; Rev. I. MacGrathy, parish priest.

Brewood (STAFFS.).—Cinema theatre, Stafford Street, for T. A. Webb, Bilston, and N. F. Burslem, Wolverhampton.

Brighton.—Houses (110), Tarners estate (£42,128); A. Snape and Son, builders, Plymouth. Mental hospital, Beechmount estate (£23,215); Clayton & Black, architects.

Burnley.—Senior school, Towneley, and extension of Abel Street and Rosegrove Council schools (£13,500); director of education.

Chadderton.—Extension of the sewage disposal works; J. Diggle & Son, engineers, Hindhill Street, Heywood.

Chester.—Houses (282) and shops for the T.C.; France and Heywood, builders, Chester Road, Whitby, Wirral.

Chesterfield.—Cinema, Winchcomb Road; Albany Ward Theatres, Ltd. Extensions, Savoy Hotel, Bayshill Road; F. Gregg.

Cleethorpes.—Police buildings; B. Pumfrey, Ltd., contractors, Gainsborough.

Coventry.—Houses (470), Hen Lane estate (£143,748); city engineer.

Croydon.—St. Mildred's Church, Addiscombe (£20,000); Rev. Dr. Charles Budden.

Dudley.—Houses (186), Priory estate; borough engineer.

Dundee.—Reconditioning of Old Harris Academy (£8,000); city architect. Municipal Offices, City Square; city engineer, 91, Commercial Street. Additions to the premises of A. Stewart and Son (1924), Ltd., 40, Castle Street; A. Friskin, architects, 26, Castle Street.

Durham.—Schools, New Silkworth, Witton Gilbert, and extensions to Henry Smith School, Hartlepool, for the E.C.; F. Willey, architect, 34, Old Elvet.

Earsdon (NORTHUMBERLAND).—Housing scheme, Holywell Village, for the U.D.C.; Mr. Burgess, surveyor.

Elgin (N.B.).—Housing scheme; burgh surveyor.

Epsom.—Extensions, Poor Law Institution (£8,250); Surrey county architect, Kingston.

Essex.—Enlargement of secondary school, Brentwood, for the county E.C.; J. Stuart, architect, Chelmsford.

Farnworth.—Alterations and improvements to St. Peter's Church of England Schools; F. Thorpe, architect, Union Bank Chambers, Church Lane, Oldham.

Fleetwood.—Houses (190), Flakefleet site; U.D.C. surveyor. School, Flakefleet site, Fleetwood Road; H. Stonestreet, district clerk, Education Offices.

Gainsborough.—Extension of Courthouse, &c.; B. Pumfrey, Ltd., contractors.

Glasgow.—Houses (787) for the Corporation; city architect. Extensions to the premises of J. & A. Ferguson, Ltd., 67, Union Street; Burnet & Boston, architects, 180, Hope Street. R.C. church; rector of St. Anne's Church, Mile End.

Gloucestershire.—School, Chipping Sodbury, for the county E.C.; director of education, Gloucester.

Guiseley.—Houses (44); Nunroyd site; T. C. Slack, surveyor to the U.D.C., Town Hall.

Hampshire.—Junior school (£3,840), Wootton Milton, and extensions to Chilworth Council School (£7,000), for the county E.C.

Hartley Wintney (BASINGSTOKE).—Houses (40) for the R.D.C.; surveyor.

Hawarden (CHESHIRE).—Houses (84) for the R.D.C.; surveyor.

Haydock (LANCS.).—Houses (50) for the U.D.C.; H. Horridge, builder.

Hemel Hempstead (HERTS.).—Houses (20), Markyate, for Franklin & Co.

Hertfordshire.—Schools, Rye Park, Hoddesdon (£14,012), for the county E.C.; county surveyor, Hatfield. Junior schools, Knebworth; director of education, Hertford. School, Welwyn Garden City (£12,702); Keeble, Ltd., builders, Soho, London, W.

High Wycombe.—Re-erection of factory, Desborough Road, for W. Keen (£8,000).

Horsham.—Sewage works (£94,000); U.D.C. surveyor.

Hull.—Houses (44), Hall Road; S. H. Wrightson. Extensions, Ainthorpe school (400 places); city architect.

Irish Free State.—(CORK).—Cinema, Patrick Street and William Street, for the Irish Cinema Trust, Ltd. (£52,250); Meagher & Hayes. (LIMERICK).—Alterations and extensions to county infirmary for Committee of Management; Sheahan and Clery, architects, Cecil Chambers.

Kenley.—Development of Sherwood Oaks estate; W. J. Burstow, architect.

Kirkcudbrightshire.—School, Dalry, for the county E.C.; W. A. Mackinnell, architect, Kirkcudbright.

Lancashire.—Schools, Formby, Listerland, Lowton (£39,000), and Orrell (£27,000); director of education, County Offices, Preston.

Leeds.—Alterations, Premier Picture Palace, South Accommodation Road; manager. Shops, Harrogate Road; Sir H. B. Bacon.

Leicester.—School for Rev. B. C. George, of St. Patrick's Church, Cannon Street; Bedingfield & Grundy, architects, Museum Street.

Liverpool.—Extensions, Walton Hospital, and girls' secondary school, Fazakerley; land steward and surveyor (architectural department), Municipal Buildings.

London.—(BELLINGHAM).—Shops and houses for the London C.C. (£10,545); H. & J. Taylor, builders, Hither Green Lane, Lewisham, S.E. (CHISWICK).—Christian Science church; Davidson, Son & Sherwood, architects, 14, Rectory Drive, Gosforth, Newcastle-on-Tyne. (ILFORD).—Houses (26), Glenwood Gardens; A. Smith. Heating installation, isolation hospital; J. R. Preston, consulting engineer. (PLAISTOW).—Stores extensions, 295-7, Barking Road, for Messrs. Turpins. (SOUTHWARK).—Buildings, Rushworth Street and King's Bench Walk; Milner and Craze, 5, Regents Court, E.C.4. (WANDSWORTH).—Municipal offices, &c. (£300,000); E. Hunt, architect.

Maidenhead.—School, North Town (£25,757), for the borough E.C.; W. Creed & Co., builders.

Manchester.—Alterations to buildings in North Street, W. Dale, builders, 43, Cannon Street. Hospital, Alms Hill; governors, Northern Hospital for Women and Children. Schools, Crowcroft Park (£17,000) and reconstruction of Hyde Road School, Gorton (£7,000); city architect. Senior school, Old Moat; Smith & Briggs, Ltd. Ladybarn Municipal Senior School, Withington; surveyor's department, Education Offices, Deansgate. Extensions, New Moston School; Ogden Bros., Ltd., Oldham.

Middlesbrough.—Houses (100), Brambles Farm (£31,265); S. Coates, Ltd., contractor, Lanbourgh Place.

Monkseaton.—Union Methodist church; Rev. W. J. Bull, superintendent minister.

Newark.—Houses (20), Balderton parish; R. Oakden, 27, Winchelsea Avenue.

Norris Green.—Church of St. Christopher; B. A. Miller, architect, Glenmore Road, Birkenhead.

Perth.—School at Cherrybank (£6,000); master of works, E.C.

Plymouth.—Houses (42), Ernesettle estate; F. J. Stanbury.

Rawtenstall.—Houses (36), Ashworth Lane, Edgeside, Waterfoot; borough surveyor, Town Hall.

Reading.—Engine shed extensions (£30,000), with electrical equipment and floodlighting for the yard, for the Great Western Railway Co., Ltd.

Redcar (YORKS.).—Methodist church; E. Dover, builders, Croft Road, Blyth.

Richmond.—Extensions, hospital; D. Matthews, Son & Ridley, architects, 3, Paul's Bakehouse Court, E.C.4.

Rochdale.—Extensions and alterations to Kings Road Cinema; Drury & Gomersall, architects, 22, Imperial Buildings, 15, Oxford Road, Manchester. Hospital; borough surveyor.

Rotherham.—Conversion of technical college to municipal offices; borough engineer.

Rowley Regis.—Houses (74), Bearmore estate, Cradley Heath; D. Wright, clerk to the U.D.C., Old Hill.

Salford.—Equipment of Hope Hospital (£40,000); medical officer of health.

Sheffield.—Houses (448), Wybourn estate (£155,191); R. Charlesworth, Ltd. Bank, Ecclesall Road; Sheffield Savings Bank.

Shoreham (SUSSEX).—Re-erection of joinery works and offices for White & Co. (£50,000).

Sittingbourne and Milton (KENT).—Houses (54) for the U.D.C.; W. M. Lashmar, surveyor.

Smethwick.—Clearance scheme, Halfords Lane; borough engineer.

Southport.—Junior and infants' school, Farnborough Road; director of education.

Stockport.—Alterations to the Hippodrome, St. Petersgate, for the Associated Buxton Cinemas, Ltd. (£10,000); P. Cummings, architect, 27, King Street, West, Manchester.

Sunderland.—Houses (150), Marley Pots estate, for the T.C.; Mr. Collinge, borough engineer. School near West Park (£20,000) and extensions to Bede Collegiate Boys' School for E.C.; G. Matkin, borough architect.

Surrey.—Boys' school (£49,365) and girls' school (£53,302), Coulsdon and Purley, for the county E.C.; W. W. Finny, secretary, Kingston-on-Thames. School, Poplar Road, Merton (£15,995), for the county E.C.; H. Hann, builder. Schools, Kingston (£45,000), Wallington, and Knaphill, Woking (£9,635), for county E.C.; county architect, Kingston-on-Thames.

Swadlincote (DERBYSHIRE).—Houses (48), Gresley, for the U.D.C.; surveyor.

Swinton (NEAR MANCHESTER).—Post Office, &c.; H.M. Office of Works (contracts branch), King Charles Street, London, S.W.1.

Timperley.—Congregational church; secretary, Cheshire Congregational Union.

Truro (CORNWALL).—Extensions, Diocesan Training College (£35,000); principal.

Tunbridge Wells.—Boys' senior school (£22,900), for the borough E.C.; director of education.

Twickenham.—Bank, three shops and flats, Percy Road; H. M. Grellier & Sons, architects. Cinema, Hounslow Road; R. J. Ward, architect.

Wallasey (CHESHIRE).—R.C. church (£30,000); J. A. Milestone & Son, builders.

Warwick.—Sewage works (£40,000); borough engineer.

Wiltshire.—Senior school (320 places), Ludgershall, for the county E.C.; T. Walker, county architect, Trowbridge.

Winchester.—Domestic science centre for the T.C.; H. Johnson and Ebbs, architects, High Street.

York.—Public baths (£36,000) for the T.C.; city surveyor.